

Liebert® CRV™ Row-Based Cooling System

A SmartAisle™ Technology

System Design Manual—600mm and 300mm Wide, Air-Cooled, Water/Glycol-Cooled and Chilled Water Cooled Units

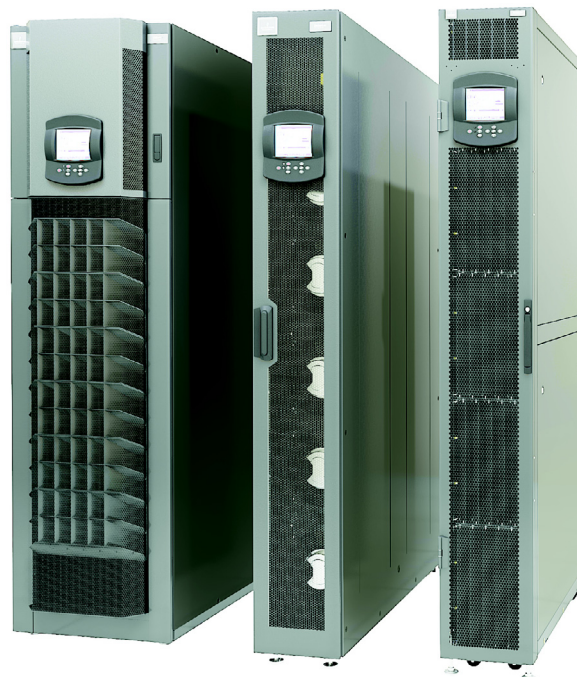


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MODEL NUMBER NOMENCLATURE - 25 DIGIT CONFIGURATION NUMBER ¹

Model # Part 1										Model Details											Model # Part 2			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
C	R	0	2	0	R	A	1	C	7	S	D	1	8	1	1	E	L	1	0	P	A	—	—	—

Digits 1-2 - Unit Family

Liebert CRV = CR

Digits 3-5 - Nominal Capacity, kW

DX = 019 (300mm [12"] wide)

020, 035 (600mm [24"] wide)

CW = 032 (300mm [12"] wide)

040 (600mm [24"] wide)

Digit 6 - Row-Based, Unit Depth

R = 1100mm (43.4")

Digit 7 - System Type

A = Air-Cooled

W = Water/Glycol-Cooled

C = Chilled Water-Cooled

Digit 8 - Fan Type

1 = Variable Speed EC fans

Digit 9 - Power Supply

A = 460V / 3ph / 60Hz (600mm [24"])

C = 208V / 3ph / 60Hz (600mm [24"])

Y = 208-230V / 3ph / 60Hz (300mm [12"])

P = 208-230V / 1ph / 60Hz (300mm [12"] Control transformer
can be tapped to provide 240V/1ph/60Hz)

K = 120V / 1ph / 60Hz (300mm [12"])

3 = 460V/3ph/60Hz-Wye with Neutral required (300mm [12"])

Digit 10 - Cooling System

2 = Two-Way Valve (CW Models Only)

3 = Three-way Valve (CW Models Only)

7 = R-410A Digital Scroll (Air-Cooled and 600mm [24"] W/G
Only)

4 = Top Connections Only (300mm [12"] W/G only)

5 = Bottom Connections Only (300mm [12"] W/G only)

Digit 11 - Humidifier

0 = None

S = Steam Generating Canister (600mm [24in.] models only)

Digit 12 - Control SystemD = Liebert iCOM[®] with Large Graphic Display**Digit 13 - Reheat**

0 = None

1 = Electric Reheat (600mm [24in.] models only)

Digit 14 - Air Filter

A = 2" MERV 8 (300mm [12in.] models only)

C = 1/2" MERV 1 and Clog Filter Switch (300mm [12in.]
models only)8 = 4" MERV 8 + Clogged Filter Switch (600mm [24in.] models
only)9 = 4" MERV 11 + Clogged Filter Switch (600mm [24in.]
models only)**Digit 15 - Water/Glycol Valve Type**

1 = Two-Way Valve (W/G only) OR Default Air-Cooled Selection

7 = Three-Way Valve (W/G only)

H = Default CW Selection

Digit 16 - Enclosure

1 = No Certification; Standard Color (Z-7021 Black)

3 = Seismic Certification Level 1 ($S_d = 0.8$); Standard Unit Without
Internal Bracing; Standard Color (Z-7021 Black)4 = Seismic Certification Level 2 ($S_d = 2.0/2.5$) With Internal bracing;
Standard Color (Z-7021 Black)**Digit 17 - High-Voltage Options**

L = No condensate pump, 5k SCCR, 300mm (12") 120V CW Only

5 = Condensate pump, 5k SCCR, 300mm (12") 120V CW Only

M = No dual-float condensate pump (for units without humidifier), 65k
SCCRP = Dual-float condensate Pump (for units with or without humidifier),
65k SCCR**Digit 18 - Option Package**

0 = None

H = Reheat and Humidifier Lockout Contact (600mm [24"] Only)

C = Reheat and Humidifier Lockout and Additional Alarm Contact
(600mm [24"] Only)

D = Low Sound Package (600mm [24"] DX Only)

L = Low Sound Package and Reheat and Humidifier Lockout and
Additional Alarm Contact (600mm [24"] DX Only)**Digit 19 - Liebert IntelliSlot[™] Housing**

0 = No Cards

C = (1) Liebert SiteLink-E[®] CardU = (1) Liebert IntelliSlot Unity DP[™] Card6 = (1) Liebert IntelliSlot Unity DP Card and (1) Liebert SiteLink-E[™]
Card

7= (2) Liebert IntelliSlot Unity DP Cards

Digit 20 - Future Options

0 = None

Digit 21 - Packaging With Ramp

P = Domestic

S = Export (Seaworthy)

Digit 22 - Special Features

A = No SFAs, Standard Unit

X = SFA Included

Digits 23-25 - Factory Configuration Number

- The 14-digit model number consists of the first 10 digits and last four digits of the configuration number.

1.0 LIEBERT CRV COMPONENT LOCATION

Figure 1 Component location, common components—600mm (24") all models

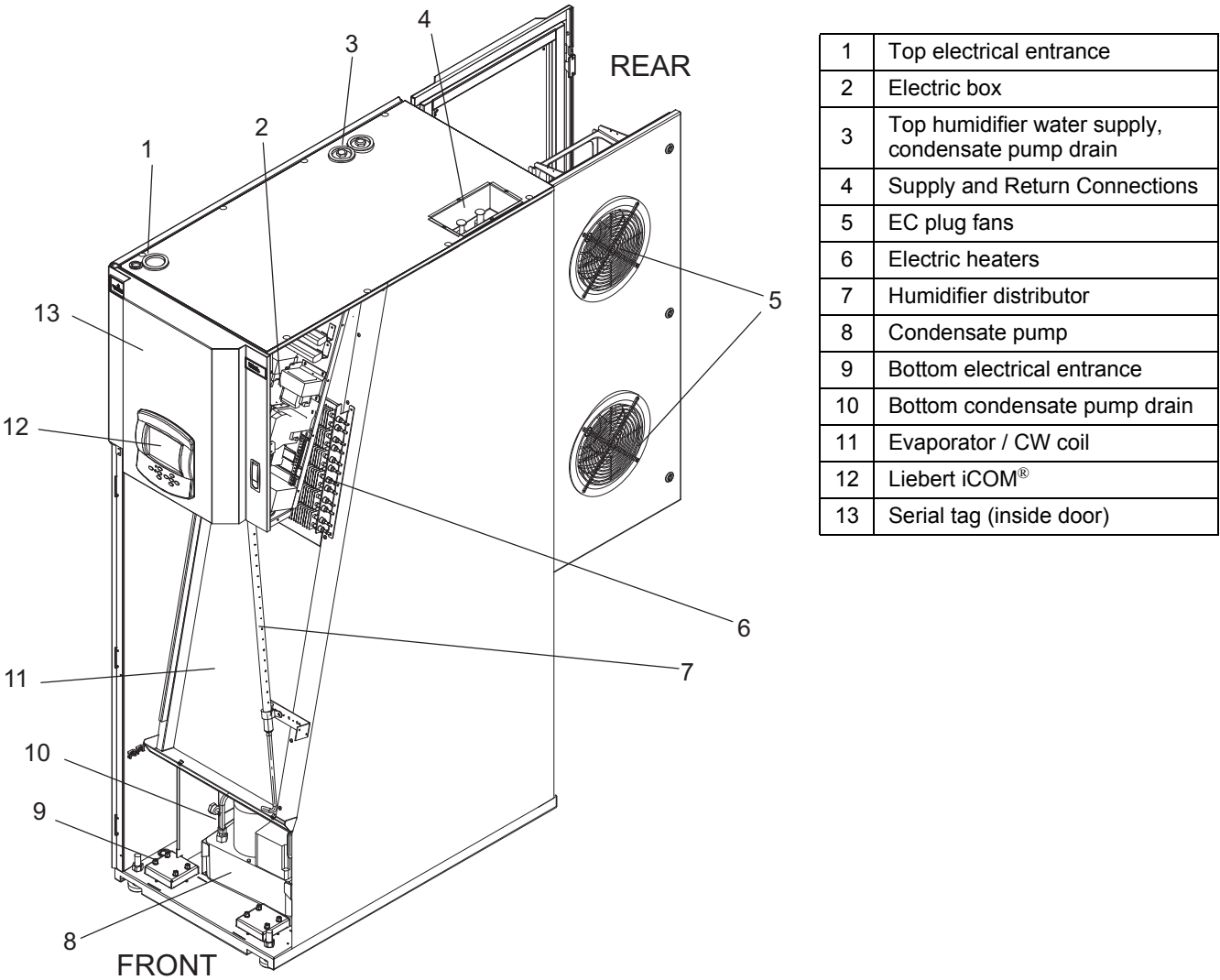


Figure 2 Component location—Liebert 300mm (12") CR019 air-cooled units

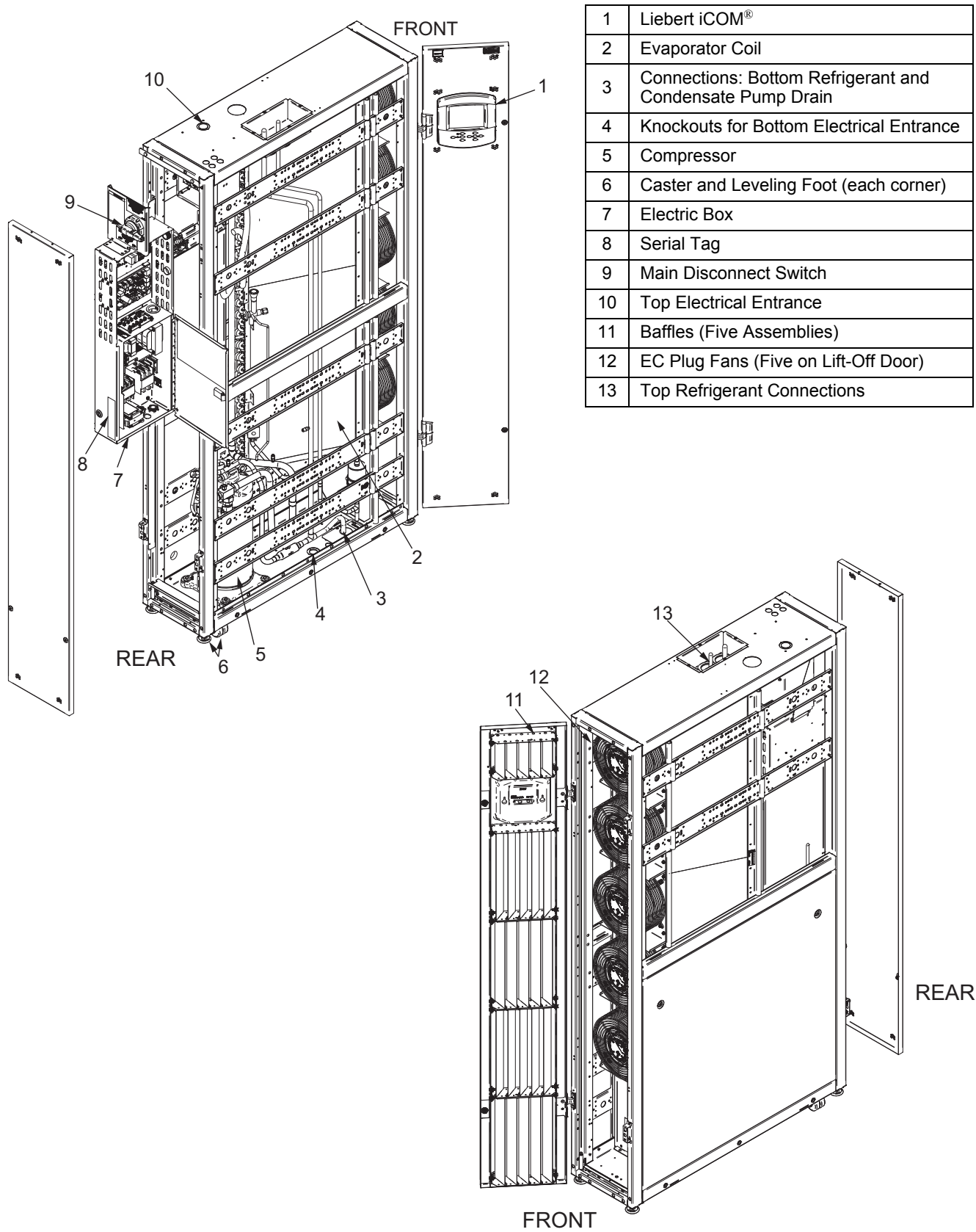


Figure 3 Component location—Liebert 300mm (12") CR032 chilled water units

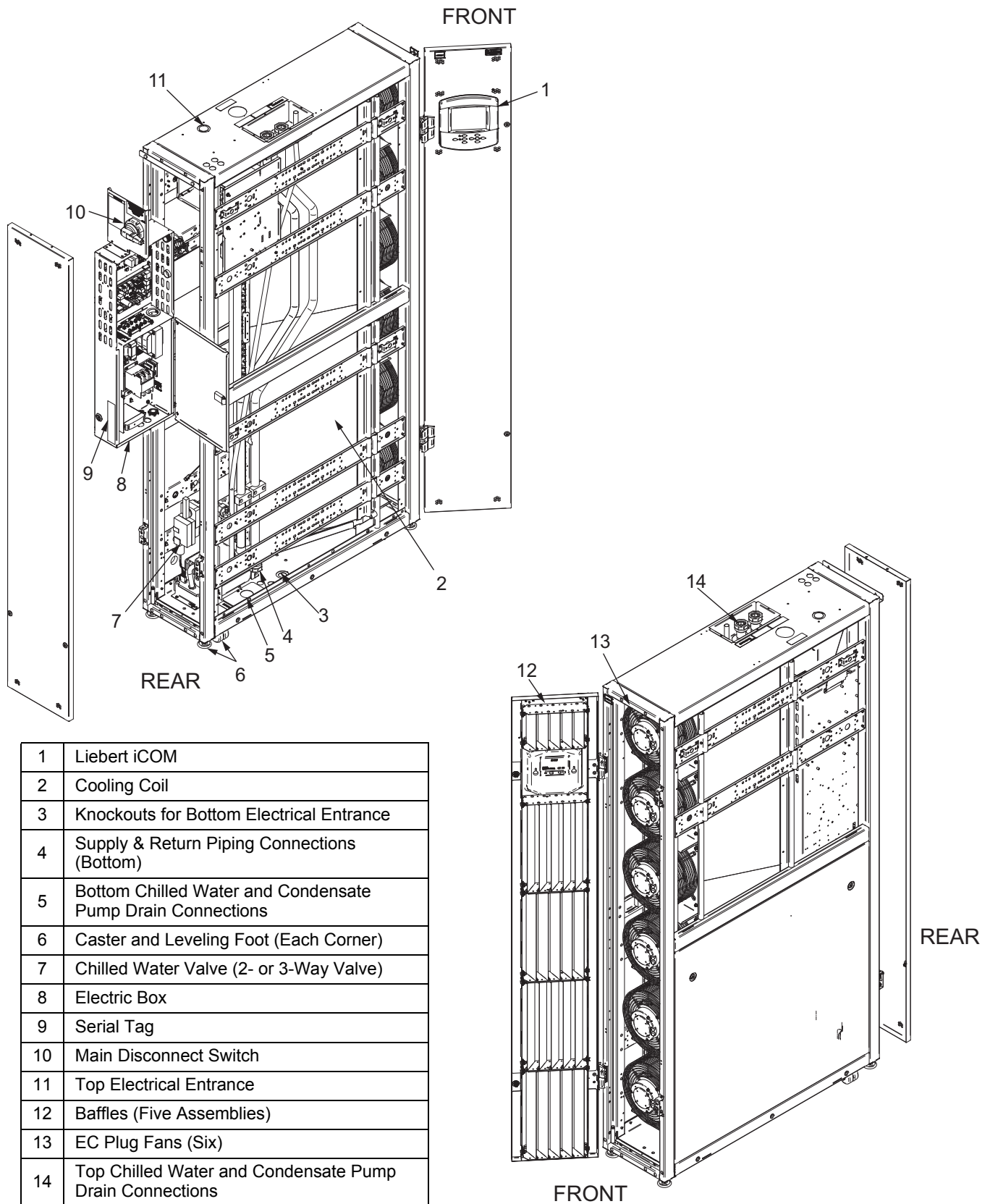
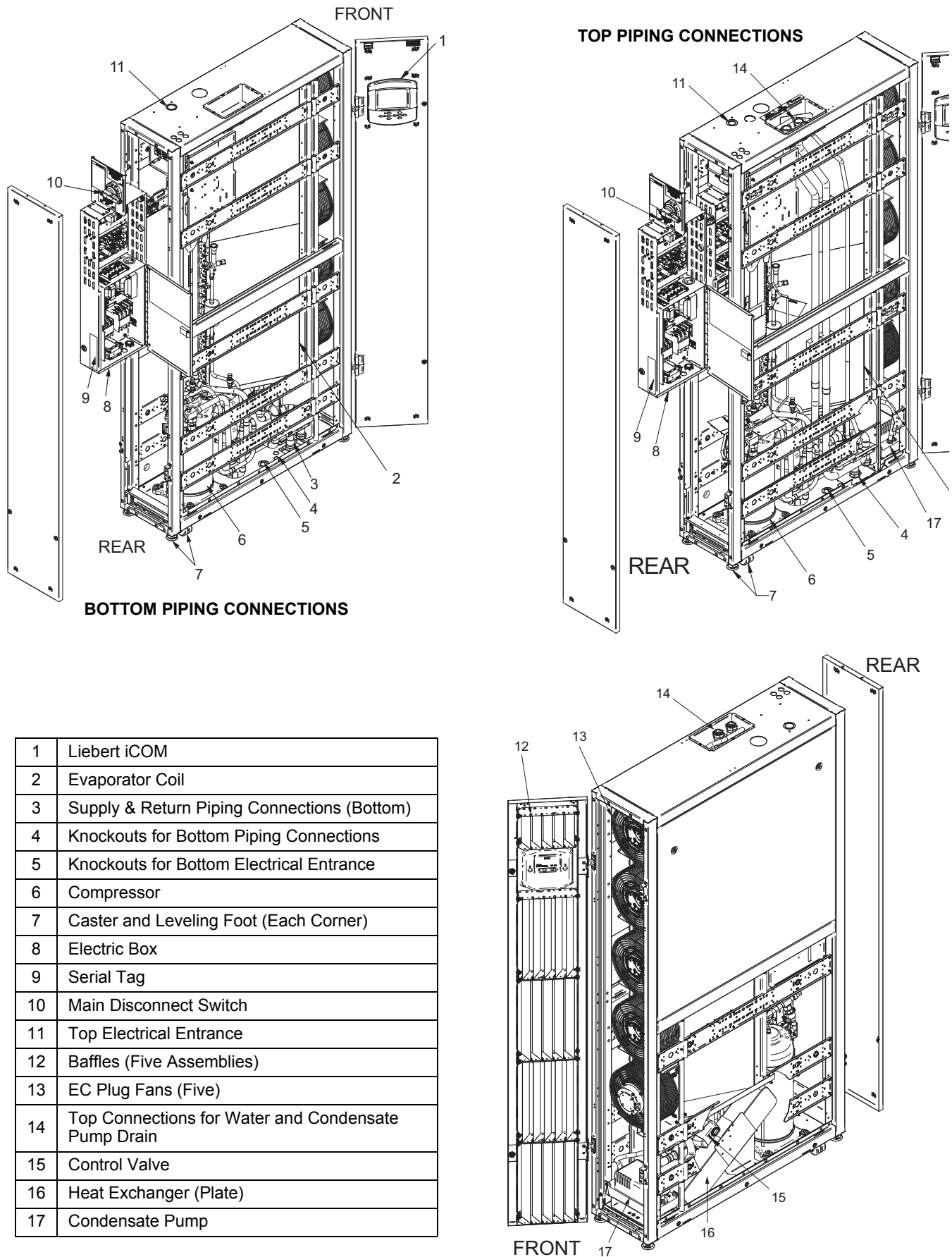


Figure 4 Component location—Liebert 300mm (12") CR019 water/glycol units

2.0 PRODUCT DESCRIPTION/CONFIGURATIONS

The Liebert CRV is a Thermal Management unit for location within a row of heat-generating IT equipment racks. The 300 series and 600 series provide all the necessary functions of a Thermal Management unit, including cooling, dehumidification, air filtration and condensate management. The 600 series is also capable of humidification.

The Liebert CRV is to be applied in hot-aisle-cold-aisle configurations. Air enters this unit from the hot aisle, is filtered, cooled and conditioned, then expelled into the cold aisle.

The Liebert CRV is optimized for maximum cooling capacity in a minimal footprint. The extremely energy efficient components of the system are managed by the Liebert iCOM® control system. The control monitors the environment in real-time with sensors on the inlet of the racks the unit is cooling. This information allows the unit to optimize its operations for both performance and energy efficiency.

All operations and sensor data can be reported remotely via a variety of communication protocols, providing end users with a built-in rack temperature monitoring system. The supply air baffle on the 600 series allows the air leaving the cooling unit to be directed to the racks the Liebert CRV is conditioning; maximizing its effectiveness, reducing the chance for hot spots and improving the overall system efficiency. The angle and spacing of the baffle vanes have been optimized through CFD modeling, laboratory testing and real-world installations. All service and maintenance is performed through the front and rear of the unit, including all component replacement. All piping and electrical connections are made through the top or bottom of the unit.

Table 1 Unit configurations

Series	Width	Cooling Type	Nominal Cooling Capacity, kW	Input Power 60Hz
600	24in. (600mm)	Air	20	208V/3ph 460V/3ph
		Water / Glycol		
		Air	35	
		Water / Glycol	35	
		Chilled Water	40	
300	12in. (300mm)	Air	19	208V/3ph 460V/3ph-Wye
		Chilled Water	32	208-230V/1ph 208-230V/3ph 460V/3ph-Wye 120V/1ph
		Water / Glycol	19	208V/3ph 460V/3ph-Wye

Figure 5 Liebert CRV, front and rear views



Front

Rear

600mm (24 inch) Air-Cooled
and CW Models



Front

Rear

300mm (12 inch) Air-Cooled and Water Glycol Models

Front

Rear

Liebert CRV 300mm (12 inch) CW Models

3.0 AIR-COOLED SYSTEMS

3.1 Capacity and Physical Data—Air-Cooled Systems

Table 2 Performance data—600mm (24 inch) units

Return Air Temperature	Standard 95°F (35°C) Ambient Condenser			
	CR020RA		CR035RA	
	Liebert Fin and Tube Condenser	Liebert MC™ Condenser	Liebert Fin and Tube Condenser	Liebert MC™ Condenser
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB) 17% RH				
Total kBTU/H (kW)	87.2 (25.5)	90.7 (26.6)	142.8 (41.8)	141.3 (41.4)
Sensible kBTU/H (kW)	87.2 (25.5)	90.7 (26.6)	142.8 (41.8)	141.3 (41.4)
100°F DB, 69.5°F WB (37.8°C DB, 20.8°C WB) 20% RH				
Total kBTU/H (kW)	83.5 (24.5)	86.8 (25.4)	136.9 (40.1)	135.5 (39.7)
Sensible kBTU/H (kW)	83.5 (24.5)	86.8 (25.4)	136.9 (40.1)	135.5 (39.7)
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB) 23% RH				
Total kBTU/H (kW)	79.8 (23.4)	82.9 (24.3)	131.7 (38.6)	130.1 (38.1)
Sensible kBTU/H (kW)	79.8 (23.4)	82.9 (24.3)	130.0 (38.1)	129 (37.8)
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB) 27% RH				
Total kBTU/H (kW)	76.1 (22.3)	79.1 (23.2)	127.5 (37.4)	125.9 (36.9)
Sensible kBTU/H (kW)	76.1 (22.3)	79.1 (23.2)	121.3 (35.5)	120.5 (35.3)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB) 31% RH				
Total kBTU/H (kW)	72.8 (21.3)	76.1 (22.3)	123.8 (36.3)	122.2 (35.8)
Sensible kBTU/H (kW)	71.9 (21.1)	73.8 (21.6)	112.0 (32.8)	111.2 (32.6)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH				
Total kBTU/H (kW)	70.5 (20.7)	73.8 (21.6)	120.3 (35.2)	118.8 (34.8)
Sensible kBTU/H (kW)	65.5 (19.2)	67.1 (19.7)	102.3 (30.0)	101.5 (29.7)

1. The net capacity data has fan motor heat factored in for all ratings.
2. Capacity data is factory-certified to be within 5% tolerance.
3. Data rated with standard filter.

Table 3 Physical data—600mm (24in.) air-cooled systems

Parameter	CR020RA	CR035RA
Fan Data		
Total Airflow, CFM (m³/h)	2454 (4170)	3260 (5540)
Total Fan Motor, hp (kW)	0.8 (0.6)	1.4 (1.06)
Number of Fans	2	
Evaporator Coil		
Face Area, ft² (m²)	7.26 (0.674)	
Rows	4	5
Face Velocity, FPM (m/s)	339 (1.72)	449 (2.28)
Electric Reheat Single Stage		
Capacity, BTU/H (kW)	460V: 20,472 (6.0) 208V: 16,719 (4.9)	
Steam Generating Humidifier		
Capacity, lb/hr (kg/hr)	5.0 (2.3)	
Capacity, kW	1.79	
Condensate Pump - Dual Float Type		
Capacity, GPM (l/m)	6.0 (22.7)	
Filter Section - Disposable Type		
	MERV 8 - Standard Pleated Filter	
Number	2	
Nominal Size, in (mm)	31-1/2 x 17-1/2 x 4 (800 x 445 x 100)	
Effective Surface Area - ft² (m²)	16.4 (1.52)	
	MERV 11 - Optional Pleated Filter	
Quantity	2	
Nominal Size, in (mm)	31-1/2 x 17-1/2 x 4 (800 x 445 x 100)	
Effective Surface Area - ft² (m²)	16.4 (1.52)	

Table 4 Performance data—300mm (12 inch) units

Return Air Temperature	Standard 95°F (35°C) Ambient Condenser @ 2250 CFM	
	CR019RA	
	MC Condenser	
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB) 17% RH		
Total, kBTU/H (kW)	87.1 (25.5)	
Sensible, kBTU/H (kW)	87.1 (25.5)	
100°F DB, 69.1°F WB (37.8°C DB, 20.8°C WB) 20% RH		
Total, kBTU/H (kW)	83.5 (24.5)	
Sensible, kBTU/H (kW)	83.5 (24.5)	
95°F DB, 67.4°F WB (35°C DB, 19.9°C WB) 23% RH		
Total, kBTU/H (kW)	80 (23.4)	
Sensible, kBTU/H (kW)	79.8 (23.4)	
90°F DB, 65.9°F WB (32.2°C DB, 19.0°C WB) 27% RH		
Total, kBTU/H (kW)	77.5 (22.7)	
Sensible, kBTU/H (kW)	74.5 (21.8)	
85°F DB, 64.0°F WB (29.4°C DB, 18.1°C WB) 31% RH		
Total, kBTU/H (kW)	75 (22)	
Sensible, kBTU/H (kW)	69.1 (20.3)	
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH		
Total, kBTU/H (kW)	73.1 (21.4)	
Sensible, kBTU/H (kW)	62.8 (18.4)	

1. The net capacity data has fan motor heat factored in for all ratings.
2. Capacity data is factory-certified to be within 5% tolerance.
3. Data rated with standard filter.

Table 5 Physical data—300mm (12in.) wide models

System	19kW Model
	DX
Fan Data	
Total Airflow, CFM (m ³ /h)	2250 (3823)
Total Fan Motor, hp (kW)	0.65 (0.48)
Number of Fans	5
Evaporator Coil	
Face Area, ft ² (m ²)	6.46 (0.6)
Rows	3
Face Velocity, FPM (m/s)	369 (1.77)
Condensate Pump - Dual Float Type	
Capacity, GPM (l/m)	208V condensate pump rated for 0.77GPM at 13 ft. (2.8 l/m at 3.9m) of total head pressure 266V condensate pump rated for 0.81 GPM at 13 ft. (3.1 l/m at 3.9 m) of total head pressure
Filter Section—MERV 1, Washable Type	
Quantity	2
Nominal Size, in (mm)	35.5 x 10.8 x 0.4 (902 x 274 x 10)
Effective Surface Area, ft ² (m ²)	2.3 (0.21)

3.2 Operating Limits—Air-Cooled Systems

The Liebert CRV is designed to operate within the working ranges in **Table 6**. These limits refer to new units and those that have been correctly installed and serviced.

Table 6 Environmental limits—all models

Parameter		Design Condition	
		Minimum	Maximum
Unit Entering Air Conditions	Temperature	75°F (23.9°C)	110°F (43.3°C)
	Relative Humidity	15%	60%
Storage Conditions	Temperature	-4°F (-20°C)	122°F (50°C)
Power Supply Tolerances		Voltage $\pm 10\%$	
		Frequency $\pm 2\text{Hz}$	

3.3 Electrical Data—Air-Cooled Models

Table 7 Electrical data—Air-cooled, 600mm (24in.) models

Voltage	CR035RA		CR020RA	
	460/3/60	208/3/60	460/3/60	208/3/60
Dehumidification, With or Without Humidifier, Reheat, Condensate Pump				
FLA	32.2	62.0	24.2	50.8
WSA	39.1	75.4	29.2	61.4
OPD	50	100	35	80
Dehumidification and Humidifier; NO Reheat, Condensate Pump				
FLA	28.4	53.8	20.4	42.6
WSA	33.4	63.1	23.5	49.1
OPD	50	100	35	70
Dehumidification and Condensate Pump; NO Reheat, NO Humidifier				
FLA	24.7	45.4	16.7	34.2
WSA	29.7	54.7	19.8	40.7
OPD	45	90	30	60
Dehumidification and Reheat; NO Humidifier, NO Condensate Pump				
FLA	31.0	59.7	23.0	48.5
WSA	37.9	73.1	28.0	59.1
OPD	50	100	35	80
Dehumidification; NO Humidifier, NO Reheat, NO Condensate Pump				
FLA	23.5	43.1	15.5	31.9
WSA	28.5	52.4	18.6	38.4
OPD	45	80	30	60

Table 8 Electrical data—Air-cooled, 300mm (12in.) models, CR019

Voltage	FLA	WSA	OPD
With Condensate Pump			
208-230V/3Ph/60Hz	33.4	39.9	60
460V/3Ph/60Hz (Wye Connected)	16.8	20	30
Without Condensate Pump			
208-230V/3Ph/60Hz	32.5	39	60
460V/3Ph/60Hz (Wye Connected)	16.3	19.4	30

3.4 Electrical Connections—Standard Features, 600mm (24in.) units

Source: DPN001884, Rev. 7, Pg. 1

1. **High-Voltage Connection Through the Bottom of the Electric Panel**—1-3/8" (34.9mm), 1-3/4" (44.5mm) and 2-1/2" (64mm) diameter concentric knockout.
2. **Low-Voltage Connection Through the Bottom of the Electric Panel**—Two knockouts, each 7/8" (22mm) diameter.
3. **High-Voltage Connection Through the Top of the Unit**—1-3/8" (34.9mm), 1-3/4" (44.5mm) and 2-1/2" (64mm) diameter concentric knockout.
4. **Low-Voltage Connection Through the Top of the Unit**—Four knockouts, each 7/8" (22mm) diameter.
5. **Three-Phase Electrical Service**—Connect to terminals on disconnect switch. Three-phase service not by Emerson. Refer to **7.6.3 - Important Note for 460V-Rated Liebert CRV Units (CR*****A)**.
6. **Factory-Installed Locking Disconnect Switch**
7. **Earth Ground**—Terminal for field-supplied earth grounding wire.
8. **Remote Unit Shutdown**—Replace existing jumper between Terminals 37 and 38 with field-supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field-supplied Class 1 wiring.
9. **Customer Alarm Inputs**—Terminals for field-supplied, normally closed contacts having a minimum 75VA, 24VAC rating between Terminals 3 and 50, Terminals 2 and 51, Terminals 5 and 55 or Terminals 3 and 56. Use field-supplied Class 1 wiring. Terminals 3 and 56 are used for humidifier alarm when a humidifier is installed. The remaining terminals are available for customer alarm inputs, such as smoke sensors and building fire alarms.
10. **Common Alarm**—On any alarm, normally open dry contact is closed across Terminals 75 and 76 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
11. **Heat Rejection Interlock**—On any call for compressor operation, normally open dry contact is closed across Terminals 70 and 71 to heat rejection equipment. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
12. **CANbus Connector**—Terminal block with Terminals 49-1 (CAN-H) and 49-3 (CAN-L) + SH (shield connection). The terminals are used to connect the CANbus communication cable (provided by others) from the indoor unit to the Liebert MC, Premium model.

CANbus Cable—CANbus cable provided by others to connect to the outdoor condenser. No special considerations are required when the total external cable connection between the indoor unit and outdoor unit(s) is less than 450 ft. (137m). A CANbus isolator is required for total external cable connections greater than 450 ft. (137m) but less than 800 ft. (243m). Cable must meet the following specifications:

- Conductors: 22-18AWG stranded tinned copper
- Twisted pair (minimum four twists per foot [305mm])
- Braided shield or foil shield with drain wire
- Low capacitance: 15pF/ft or less
- UL-approved temperature rated to 167°F (75°C)
- UL-approved voltage rated to 300V
- UV-resistant and moisture-resistant if not run in conduit
- Plenum rated: NEC type CMP, if required by national or local codes

Examples: Belden 89207 (plenum rated), or Alpha Wire 6454 Category 5, 5E or higher

3.5 Electrical Connections—Optional Features, 600mm (24in.) units

Source: DPN001884, Rev. 7, Pg. 1

13. **Condensate Pump High Water Alarm** (available when optional pump is installed)—On pump high-water indication, normally open dry contact is closed across Terminals 88 and 89 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
14. **Liebert Liqui-tect® Shutdown and Dry Contact** (available when optional Liebert Liqui-tect sensor is installed)—On Liebert Liqui-tect activation, normally open dry contact is closed across Terminals 58 and 59 for remote indication. The Liebert Liqui-tect sensor notifies the Liebert iCOM® of indication through Terminals 60 and 61. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
15. **Reheat and Humidifier Lockout**—Remote 24VAC required at Terminals 82 and 83 for lockout of reheat and humidifier.
16. **Additional Common Alarm**—On any alarm, one additional normally open dry contact is closed across Terminals 94 and 95 for remote indication. 1A, 24VAC maximum load. Use Class 1, field-supplied wiring.



NOTE

Refer to specification sheet for total unit full load amps, wire size amps and maximum overcurrent protective device size.

NOTICE

Risk of improper input power. Can cause equipment damage.

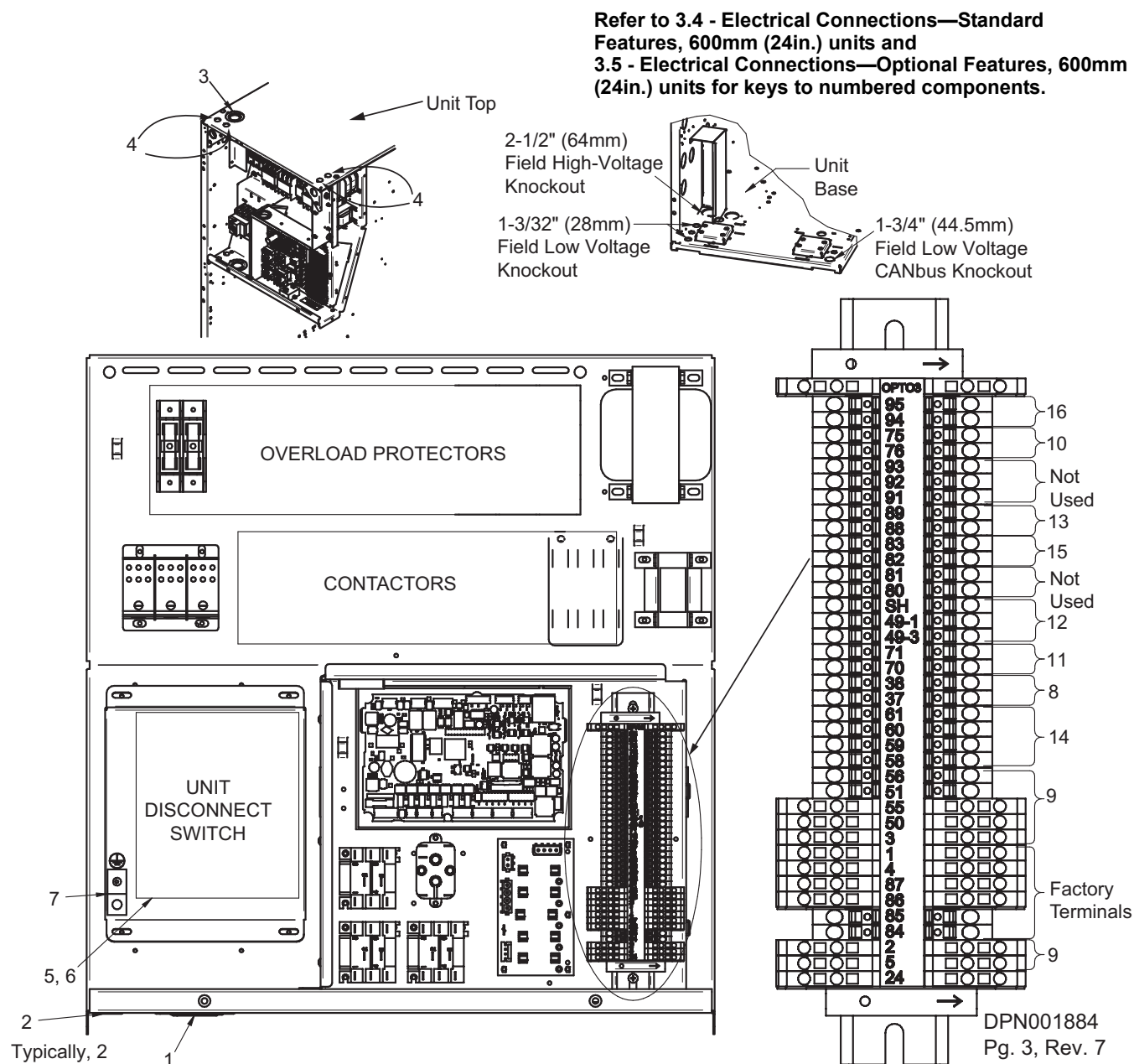
The electronically commutated motors included in the Liebert CRV—included in 480V CR035 and CR040 units—are suitable for connection to an electrical service providing input power to the unit with 300V or less line-to-ground potential only.

Acceptable Unit Input Electrical Service for 460V (480V) Nominal Units

- 480V wye with solidly grounded neutral and 277V line-to-ground

Unacceptable Unit Input Electrical Service for 460V (480V) Nominal Units

- Wye with high resistance (or impedance) ground
- Delta without ground or with floating ground
- Delta with corner ground
- Delta with grounded center tap

Figure 6 Electrical field-connection locations—600mm (24in.) units**3.6 Electrical Field Connections—Standard Features, 300mm (12in.) DX Models**

Source: DPN002810, Rev. 5

- High-Voltage Connection Through the Rear of the Disconnect Switch Box**—1-1/8" (28.6mm) and 1-3/4" (44.5mm) diameter concentric knockout.
- High-Voltage Connection Through the Top of the Unit**—1-1/4" (32mm) and 1-3/4" (44.5mm) diameter concentric knockout, not shown; see **Figure 17**.
- Electrical Service**
 - Three-Phase:** 208/230V, 60Hz units
 - Three phase with Neutral:** 460V wye-connected (5 wire, 3-phase + neutral + ground).
 - Single phase:** 208/230V (chilled water only).

Connect to terminals on disconnect switch. Electrical service not by Emerson. Use copper conductors only. Wire per local codes. Refer to specification sheet for total unit full load amps, wire size amps and maximum overcurrent protective device size. Refer to **NOTICE on page 13** for information about electrical service.)

4. **Electrical Service** (cord connected)—Refer to serial tag for unit electrical service requirements. **Single phase** – 120V, 60Hz (chilled water only). 1-3/4" (44mm) diameter knockouts provided in the top and bottom of the unit for the power cord to exit the unit. The power cord is factory-supplied with an L5-20 plug.
5. **Factory-Installed Locking Disconnect Switch**
6. **Earth Ground**—Terminal for field-supplied earth grounding wire.
7. **Low-Voltage Connection Through the Bottom of the Unit**—Two knockouts, 7/8" (22mm) diameter, not shown; see **Figure 17**.
8. **Low-Voltage Connection Through the Top of the Unit**—Two knockouts, 7/8" (22mm) diameter, not shown; see **Figure 17**.
9. **Remote Unit Shutdown**—Replace existing jumper between Terminals 37 and 38 with field-supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field-supplied Class 1 wiring.
10. **Customer Alarm Inputs**—Terminals for field-supplied, normally closed contacts having a minimum 75VA, 24VAC rating between Terminals 3 and 50, Terminals 2 and 51, Terminals 5 and 55 or Terminals 3 and 56. Use field-supplied Class 1 wiring. Terminals 5 and 55 not available when optional condensate pump is installed.
11. **Common Alarm**—On any alarm, normally open dry contact is closed across Terminals 75 and 76 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
12. **Heat Rejection Interlock**—On any call for compressor operation, normally open dry contact is closed across Terminals 70 and 71 to heat rejection equipment. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
13. **CANbus Connector**—Terminal block with Terminals 49-1 (CAN-H) and 49-3 (CAN-L) + SH (shield connection). The terminals are used to connect the CANbus communication cable (provided by others) from the indoor unit to the Liebert MC, Premium Model.
CANbus Cable—CANbus cable provided by others to connect to the outdoor condenser. No special considerations are required when the total external cable connection between the indoor unit and outdoor unit(s) is less than 450 ft. (137m). A CANbus isolator is required for total external cable connections greater than 450 ft. (137m) but less than 800 ft. (243m). Cable must meet the following specifications:
 - Conductors—22-18AWG stranded, tinned copper
 - Twisted pair (minimum four twists per foot [305mm])
 - Braided shield or foil shield with drain wire
 - Low capacitance—15pF/ft or less
 - UL-approved temperature rated to 167°F (75°C)
 - UL-approved voltage rated to 300V
 - UV-resistant and moisture-resistant if not run in conduit
 - Plenum rated—NEC type CMP if required by national or local codes**Examples:** Belden 89207 (plenum rated) or Alpha Wire 6454 Category 5, 5e, or higher

3.6.1 Electrical Field Connections—Optional Features, 300mm (12in.) DX Models

Source: DPN002810, Rev. 5

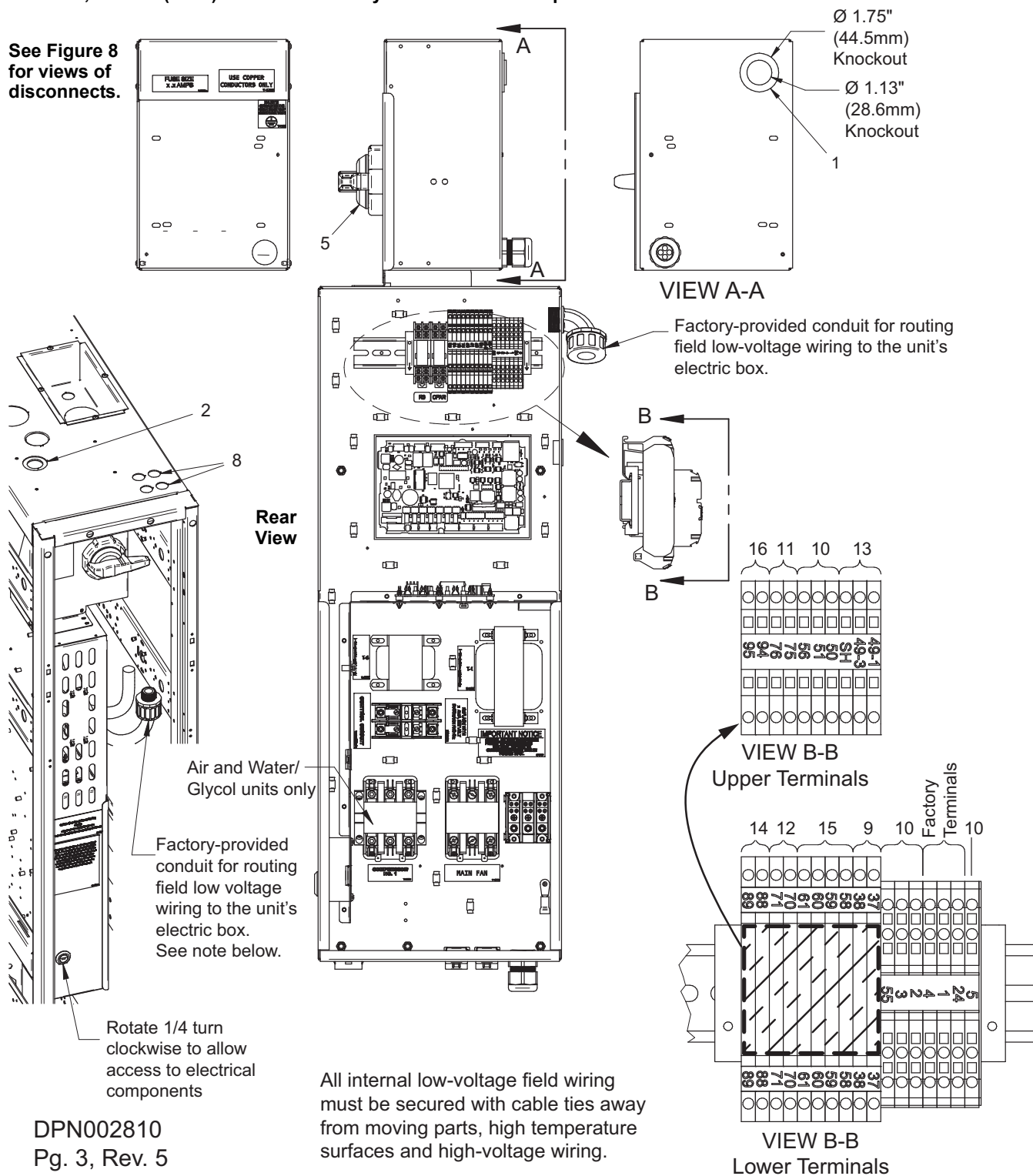
14. **Condensate Pump High Water Alarm** (available when optional pump is installed)—On pump high water indication, normally open dry contact is closed across Terminals 88 and 89 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
15. **Liebert Liqui-tect® Shutdown and Dry Contact** (available when optional Liebert Liqui-tect sensor is installed)—On Liebert Liqui-tect activation, normally open dry contact is closed across Terminals 58 and 59 for remote indication. The Liebert Liqui-tect sensor notifies Liebert iCOM® of indication through Terminals 60 and 61. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
16. **Additional Common Alarm**—On any alarm, one additional normally open dry contact is closed across Terminals 94 and 95 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.

Figure 7 Electrical field connections—300mm (12in.) DX models

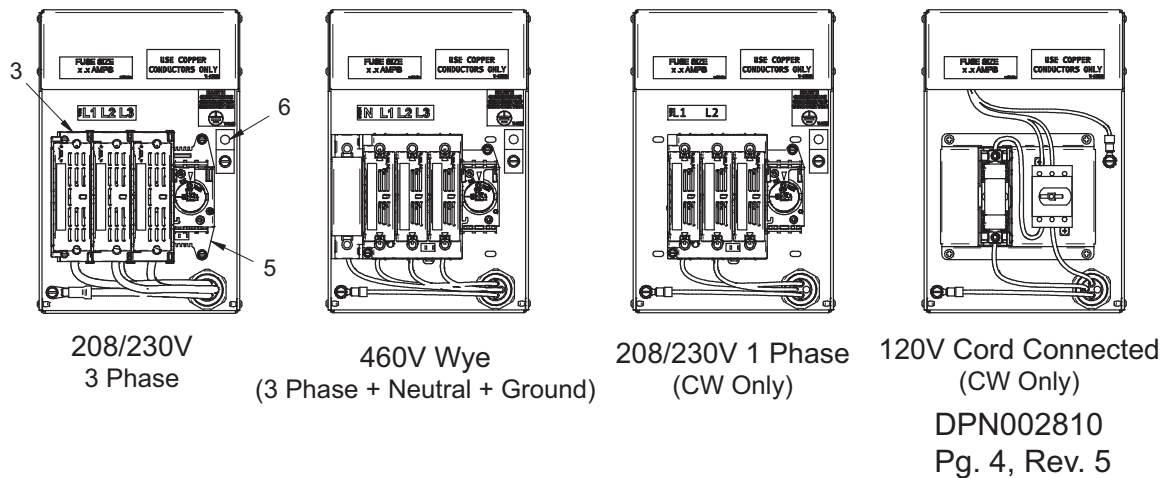
Refer to 3.6 - Electrical Field Connections—Standard Features, 300mm (12in.) DX Models and 3.6.1 - Electrical Field Connections—Optional Features, 300mm (12in.) DX Models for keys to numbered components.

See Figure 10 for low-voltage field wiring routing into the unit

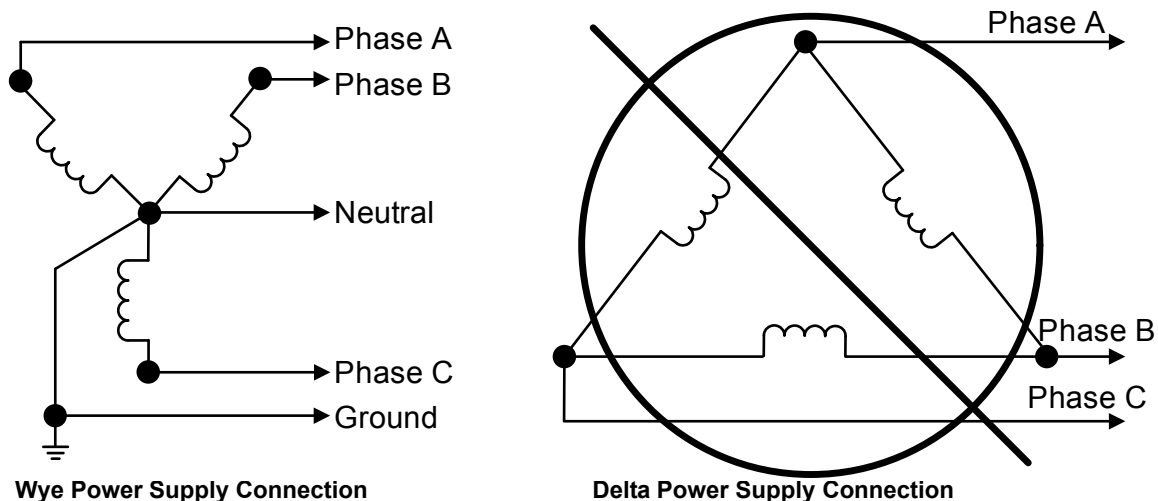
See Figure 8 for views of disconnects.



DPN002810
Pg. 3, Rev. 5

Figure 8 Electrical field connections—Disconnect views

3.6.2 Wye vs. Delta Connection Power Supply for 460V 300mm (12in.) Air-Cooled Models

Figure 9 Wye vs. delta power supply connection diagram

NOTICE

Risk of improper input power. Can cause equipment damage.

The 460V model will not operate properly with delta-connected power. A field-supplied isolation transformer or other power solution will be needed for proper function.

Acceptable Power Supplies—480V Nominal Units

- 480V wye with solidly grounded neutral and 277V line-to-ground

Unacceptable Power Supplies—480V Nominal Units

- Wye with high-resistance (or impedance) ground
- Delta without ground or with floating ground
- Delta with corner ground
- Delta with grounded center tap

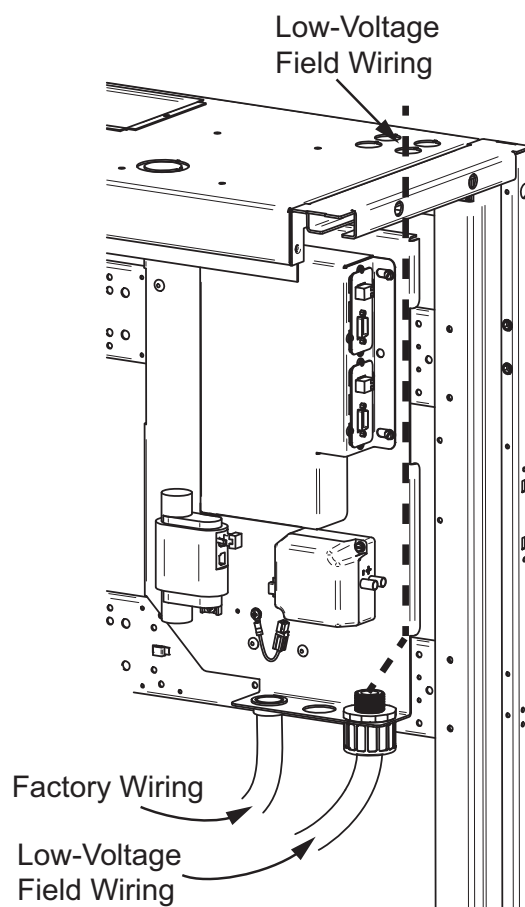
Figure 10 Low-voltage field wiring routing into the unit—300mm (12in.) DX models

Figure 11 Power cable routing—Bottom entry, 300mm (12in.) air-cooled models

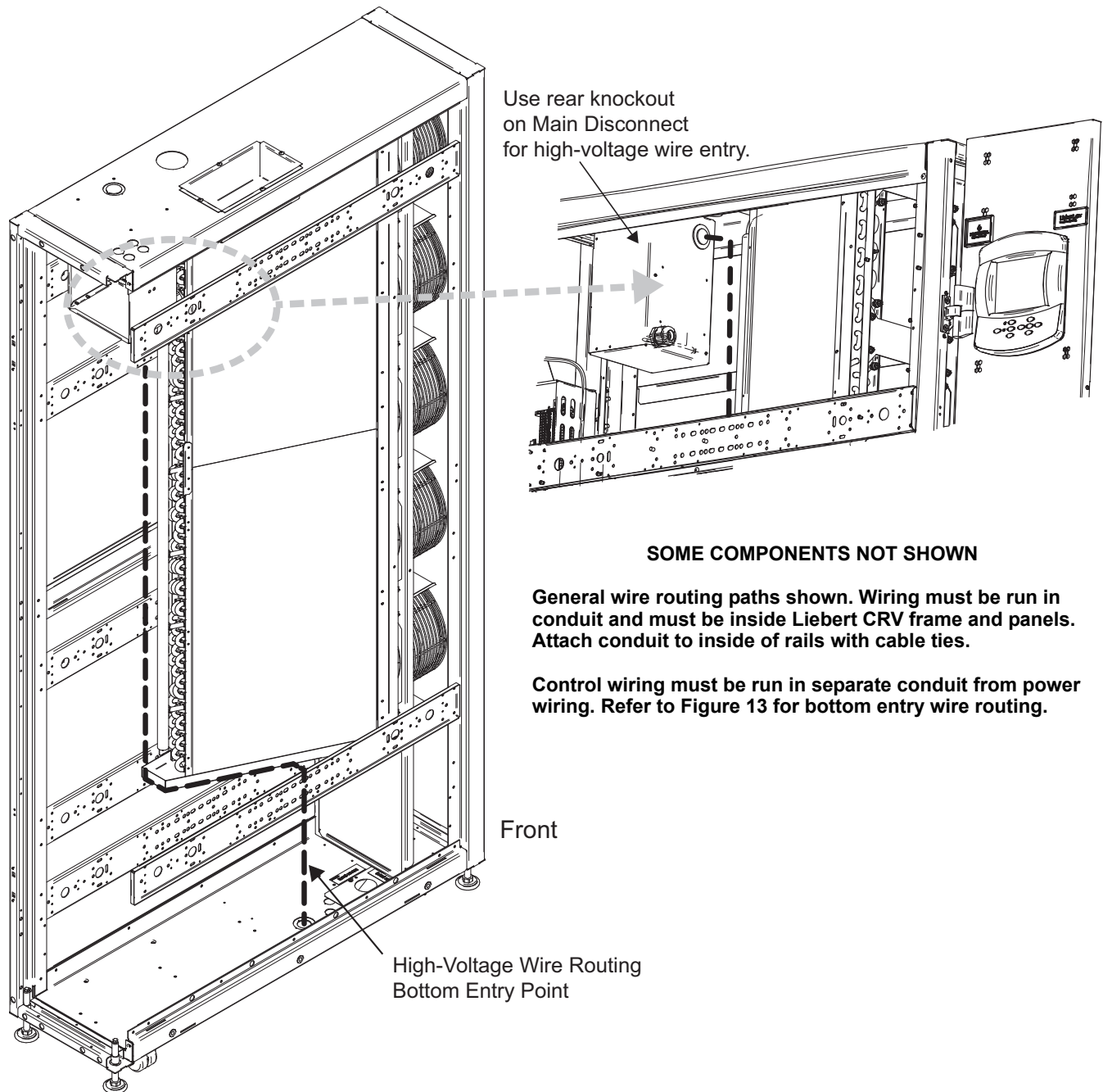


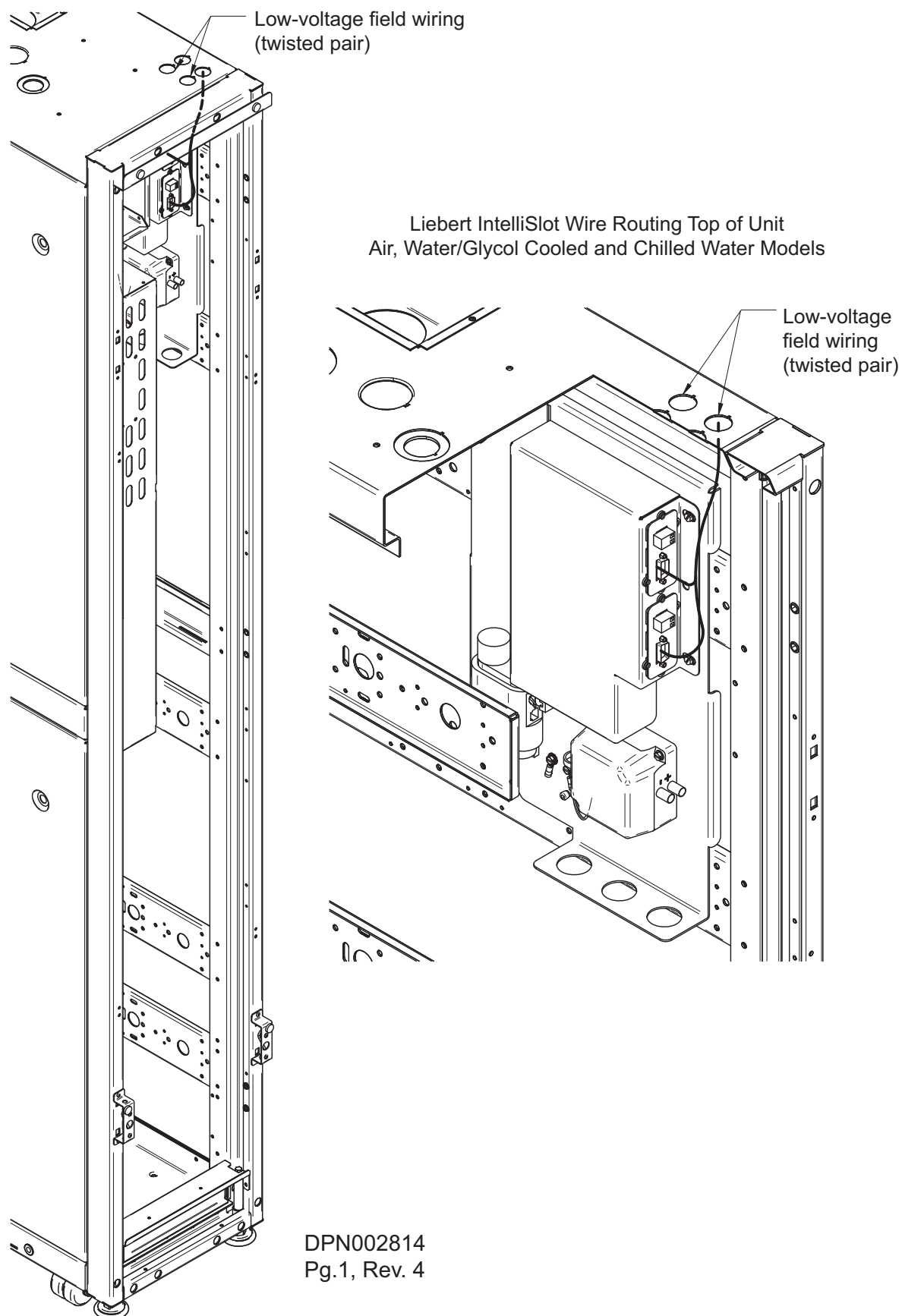
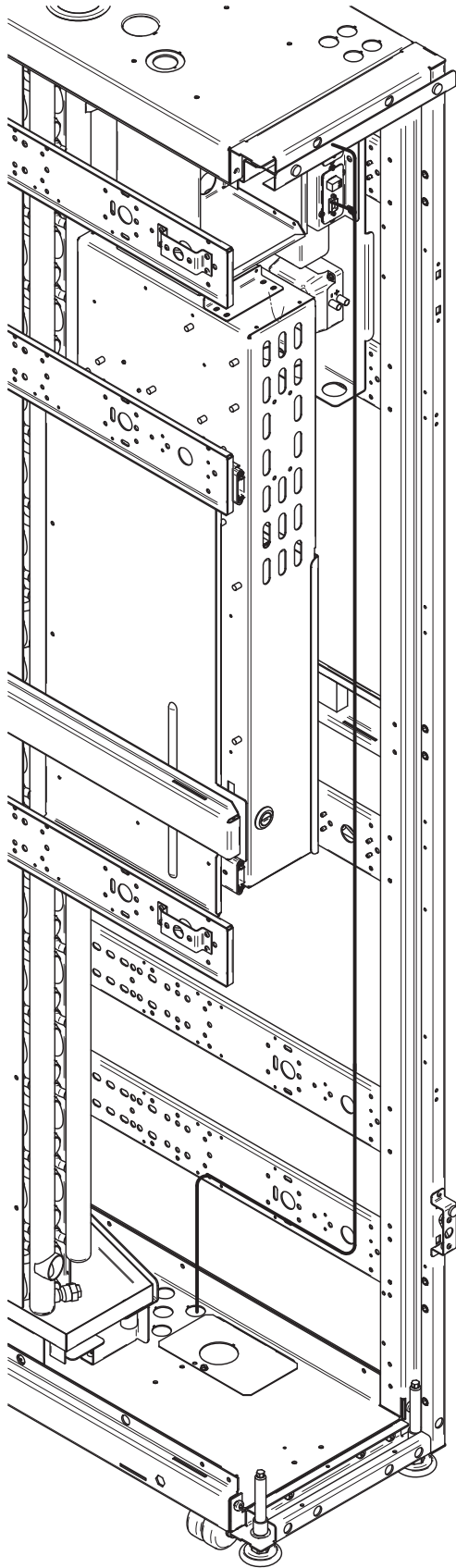
Figure 12 Liebert IntelliSlot™ cable routing—Top entry, 300mm (12in.) air-cooled models

Figure 13 Liebert IntelliSlot™ cable routing—Bottom entry, 300mm (12in.) air-cooled models

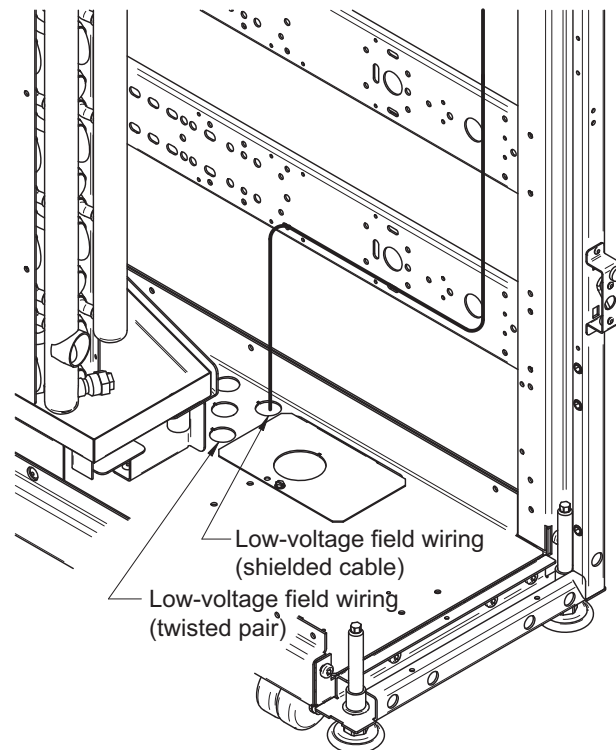


SOME COMPONENTS NOT SHOWN

General wire routing paths shown. Wiring must be run in conduit and must be inside Liebert CRV frame and panels. Attach conduit to inside of rails with cable ties.

Shielded cable may be used. If not, control wiring must be run in separate conduit from power wiring.

Secure the control wiring or conduit to the bottom edge of the rail with cable ties. Route the shielded cable up toward the Liebert IntelliSlot bays and fasten to the side rails as needed.



Secure tie the field wiring shielded cable to the rail. Route the shielded cable up toward the Liebert IntelliSlot ports and fasten to the side rails as needed.

DPN002814
Pg. 3, Rev. 4

3.7 Dimensions—Air-Cooled Systems

Figure 14 Cabinet and floor planning dimensions—Air-cooled, 600mm (24in.) wide models

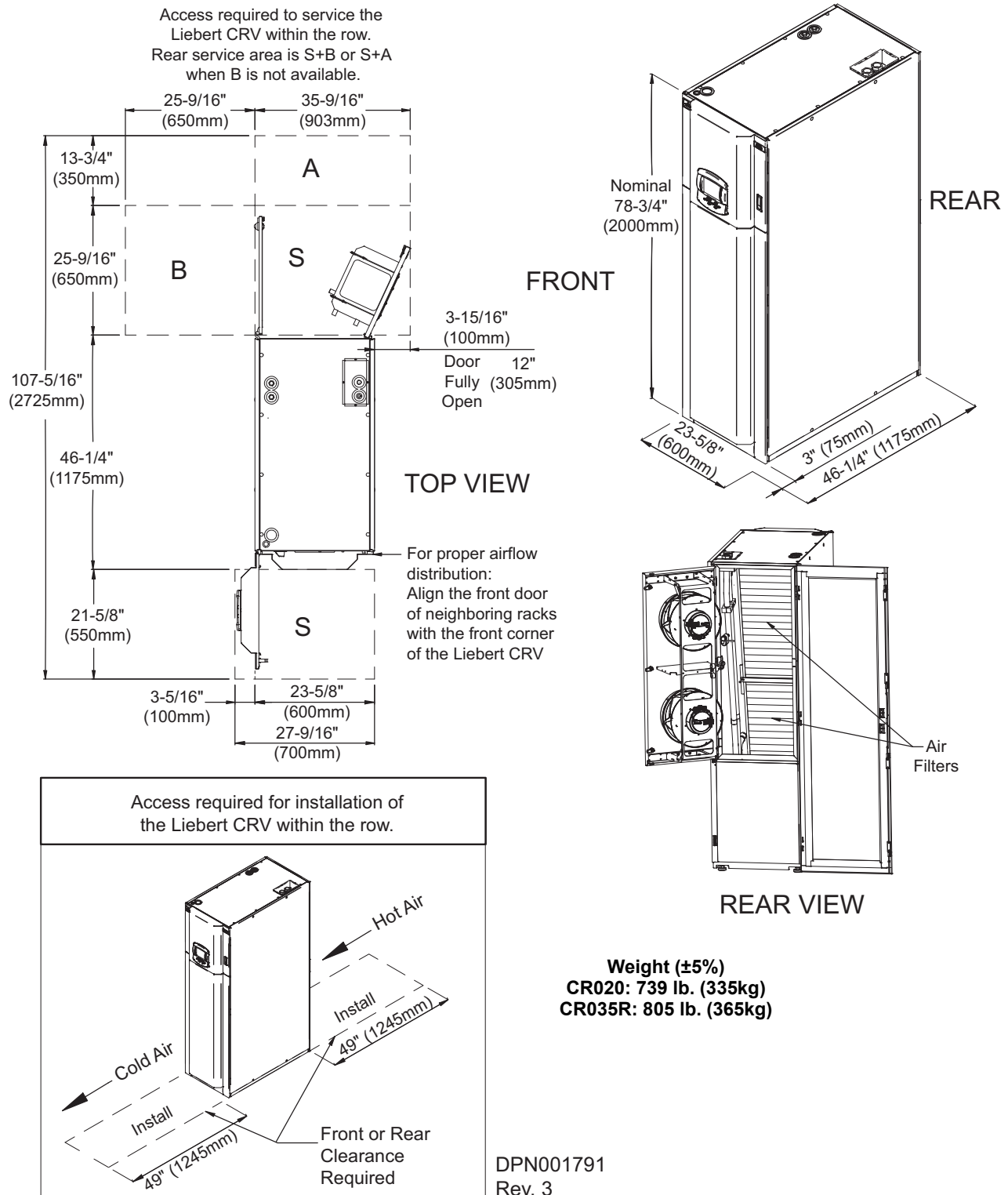
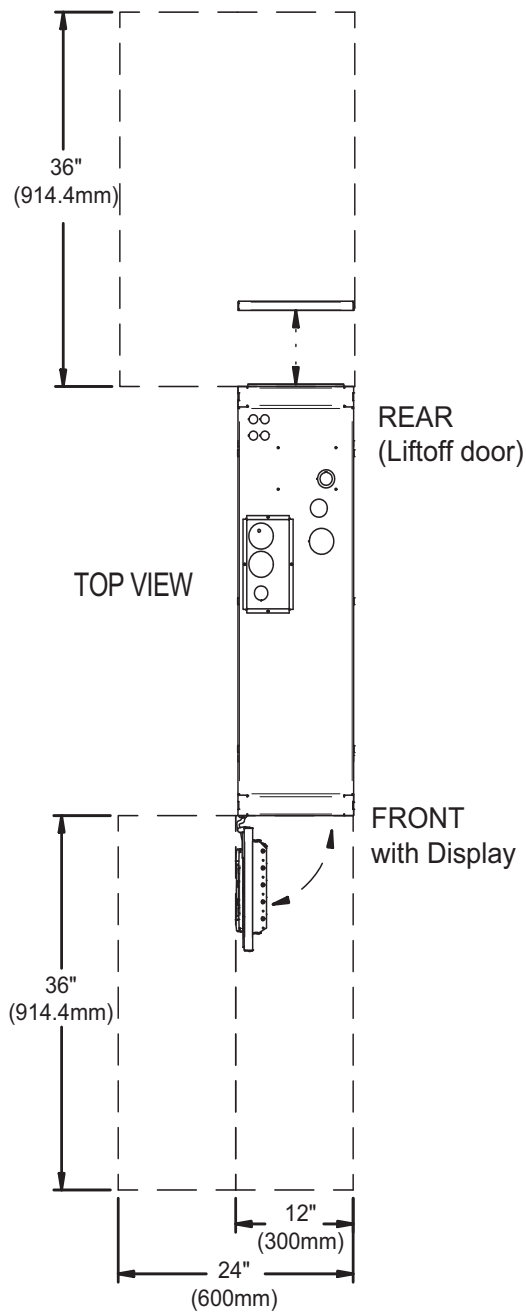


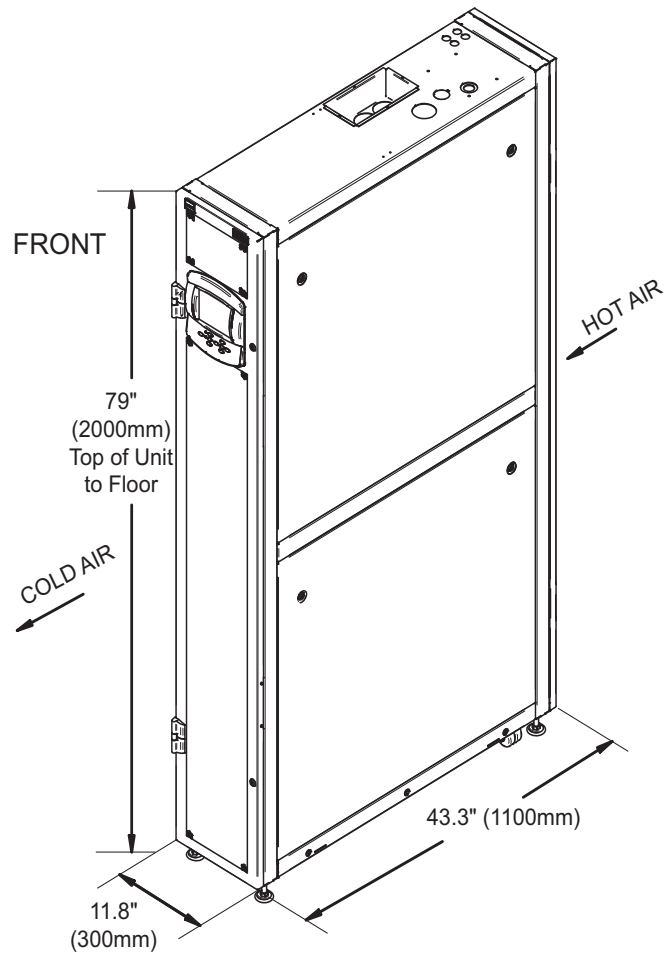
Figure 15 Cabinet and floor planning dimensions—Air-cooled 300mm (12in.) models

Access Required to Service the Unit
Between Existing Racks Within the Row



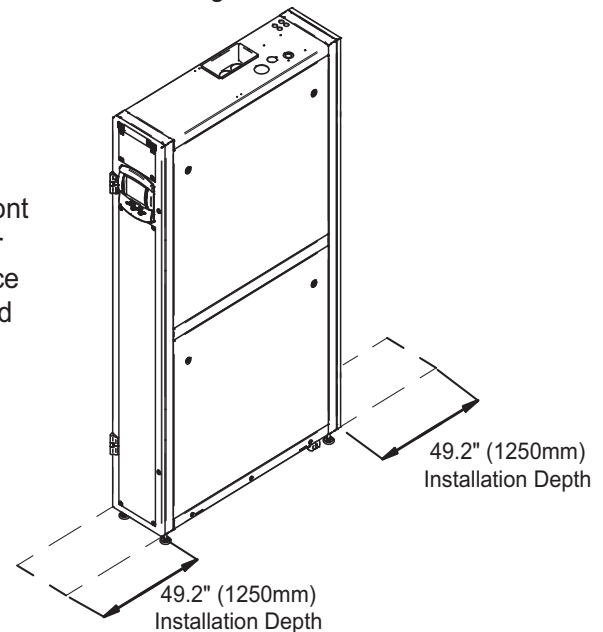
Weight (±5%)
CR019: 507 lb. (230kg)

DPN002807
Rev. 4



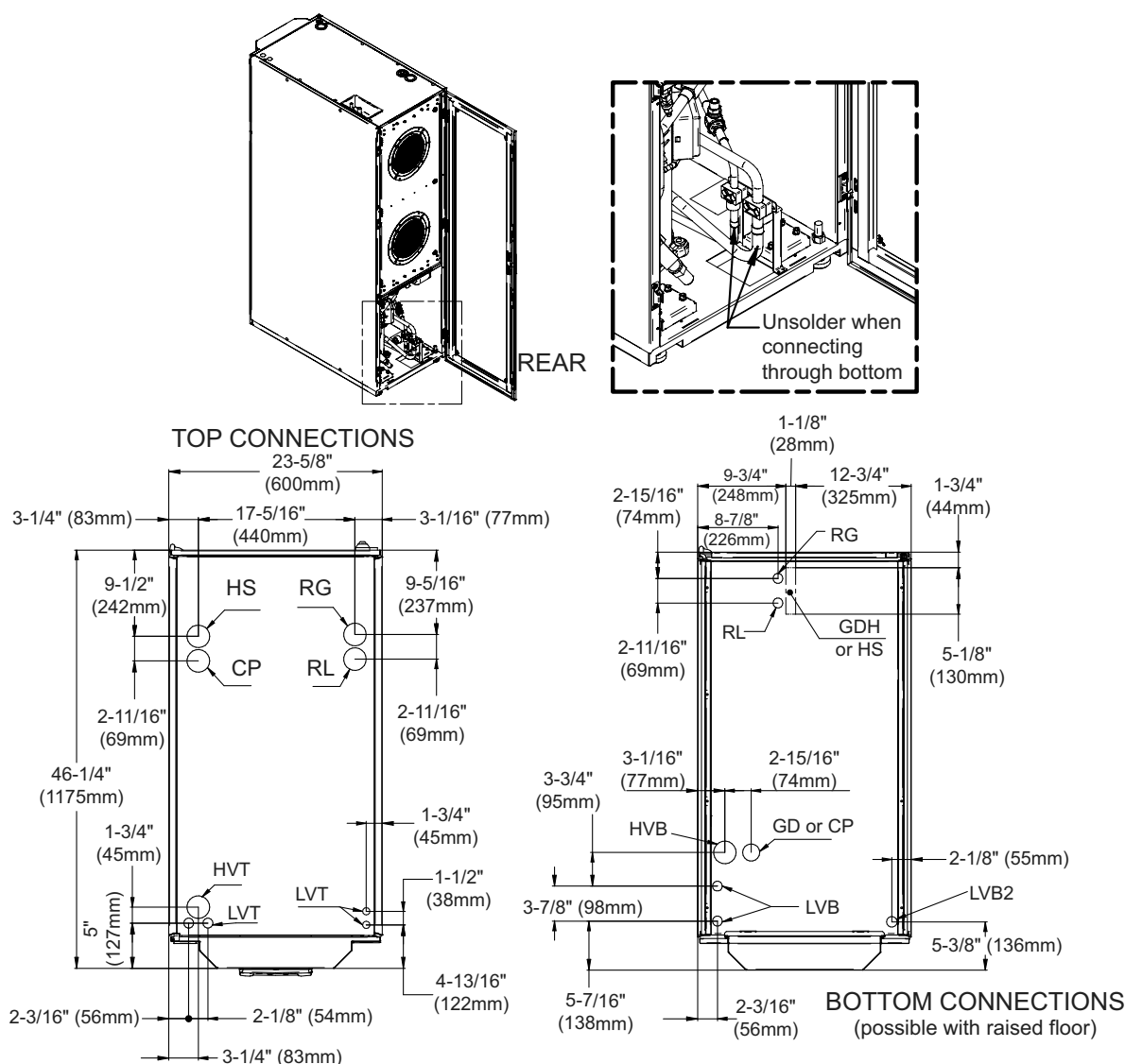
Access Required to Install the Unit
Between Existing Racks Within the Row

ONLY Front
or Rear
Clearance
Required



3.8 Piping—Air-Cooled Systems

Figure 16 Primary connection locations, air-cooled models, 600mm (24in.), digital scroll with EC fans

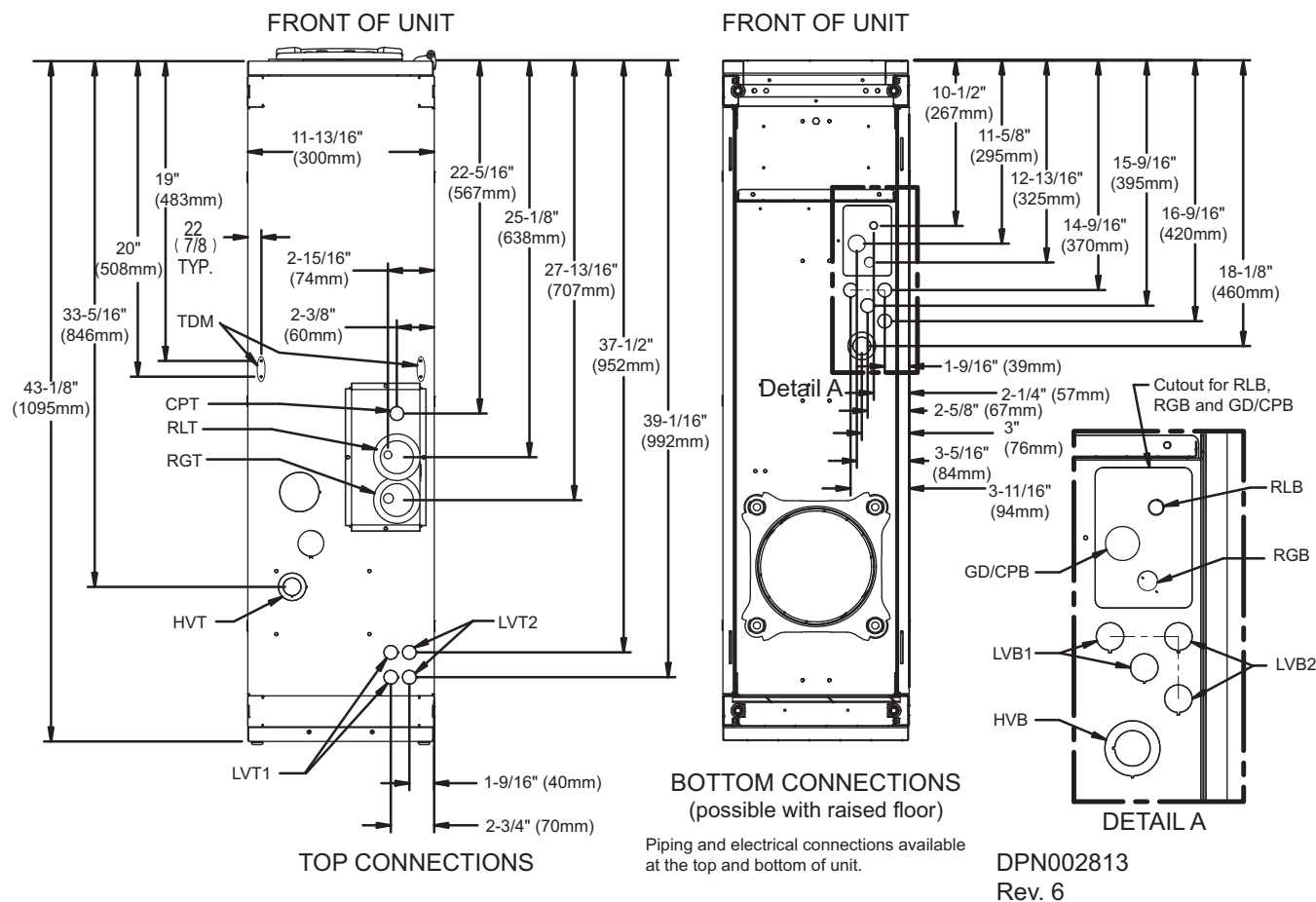


Piping and electrical connections available at the top and bottom of unit.
Air-cooled systems may require oil to be added in the field to allow sufficient compressor lubrication.

DPN001792
Rev. 3

Unit Connections		CR20A-50Hz	CR35A-50Hz	CR20A-60Hz	CR35A-60Hz
RL	Refrigerant Liquid Line Inlet	12mm O.D. Cu Sweat	16mm O.D. Cu Sweat	1/2" O.D. Cu Sweat	5/8" O.D. Cu Sweat
RG	Refrigerant Gas Line Outlet	16mm O.D. Cu Sweat	22mm O.D. Cu Sweat	5/8" O.D. Cu Sweat	7/8" O.D. Cu Sweat
GD	Gravity Coil Pan Drain	20mm I.D.		1" MPT	
GDH	Gravity Humidifier Drain	22mm I.D.		N/A	
CP	Condensate Pump	1/2" Gas F		1/2" FPT	
HS	Humidifier Supply	1/2" Gas F (Top Connection), 3/4" Gas F (Bottom Connection)		1/2" FPT (Top Connection), 1/4" Compression Fitting (Bottom Connection)	
HVT	High-Voltage Top Connection	Combination Knockout Hole Diameter 35mm (1-3/8"), 44.5mm (1-3/4") and 63.5mm (2-1/2")		Combination Knockout Hole Diameter 1-3/8" (35mm), 1-3/4" (44.5mm) and 2-1/2" (63.5mm)	
HVB	High-Voltage Bottom Entrance (feed through the base of the unit)	1 Hole, Diameter, Diameter 63.5mm (2-1/2")		1 Knockout Hole, Diameter 2-1/2" (63.5mm)	
LVT	Low-Voltage Top Connection	2 Holes, Diameter, 2, Diameter 7/8" (22mm)		4 Knockout Holes, Diameter 7/8" (22mm)	
LVB	Low-Voltage Bottom Entrance (feed through the base of the unit)	2 Holes, Diameter, 28mm (1-7/64")		2 Knockout Holes, Diameter 1-3/32" (27.8mm)	
LVB2	Low-Voltage Bottom Entrance (feed through the base of the unit)	—		1 Hole, Diameter 1-3/4" (44.5mm)	

Source DPN001792, Rev. 3

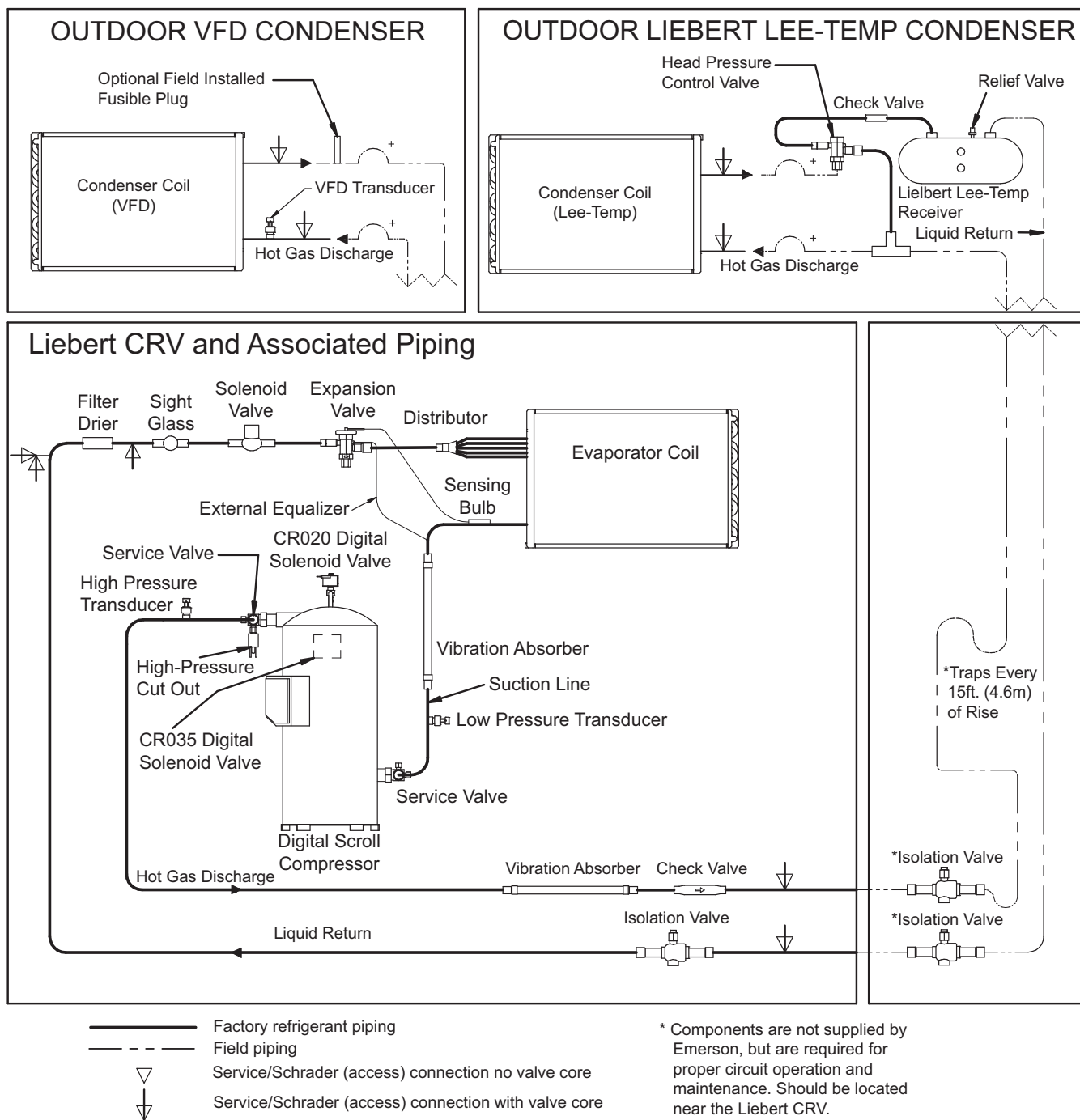
Figure 17 Connections—Air-cooled 300mm (12in.) models

Top Connections	Description	CR19, 60Hz Dimensions	Bottom Connections	Description	CR19, 60Hz Dimensions
RLT	Refrigerant Liquid Line Inlet	1/2" O.D. Cu Sweat	RLB	Refrigerant Liquid Line Inlet	1/2" O.D. Cu Sweat
RGT	Refrigerant Gas Line Outlet	5/8" O.D. Cu Sweat	RGB	Refrigerant Gas Line Outlet	5/8" O.D. Cu Sweat
CPT	Condensate Pump	Knockout 1-3/8" (35mm)	GD	Gravity Coil Pan Drain	Knockout Hole Diameter, 1-3/4" (44mm)
HVT	High-Voltage Top Connection	Combination Knockout 1-1/8" (29mm) and 1-3/4" (44mm)	CPB	Condensate Pump	
LVT1	Low-Voltage Top Connection (Twisted Pair)	2 Knockout Holes, Diameter, 7/8" (22mm)	HVB	High-Voltage Bottom Entrance (feed through unit's base)	Combination Knockout 1-1/8" (29mm) and 1-3/4" (44mm)
LVT2	Low-Voltage Top Connection (Shielded Cable)	2 Knockout Holes, Diameter, 7/8" (22mm)	LVB1	Low-Voltage Bottom Connection (Twisted Pair)	2 Knockout Holes, Diameter, 7/8" (22mm)
TDM	Tie-Down Mounting (Top)	4 Holes, Diameter 1/8" (3mm)	LVB2	Low-Voltage Bottom Connection (Shielded Cable)	2 Knockout Holes, Diameter, 7/8" (22mm)

Source: DPN002813, Rev. 6

Figure 18 General arrangement diagram, fin and tube condenser with and without Liebert Lee-Temp™—Air-cooled 600mm (24 in.) Liebert CRV models

Refer to 4.1 - Liebert MC Condenser Selections—600mm (24in.) and 300mm (12in.) CRV Units and 4.7 - Liebert Fin/Tube Condenser Selections—600mm (24in.) Units for details.



NOTES:

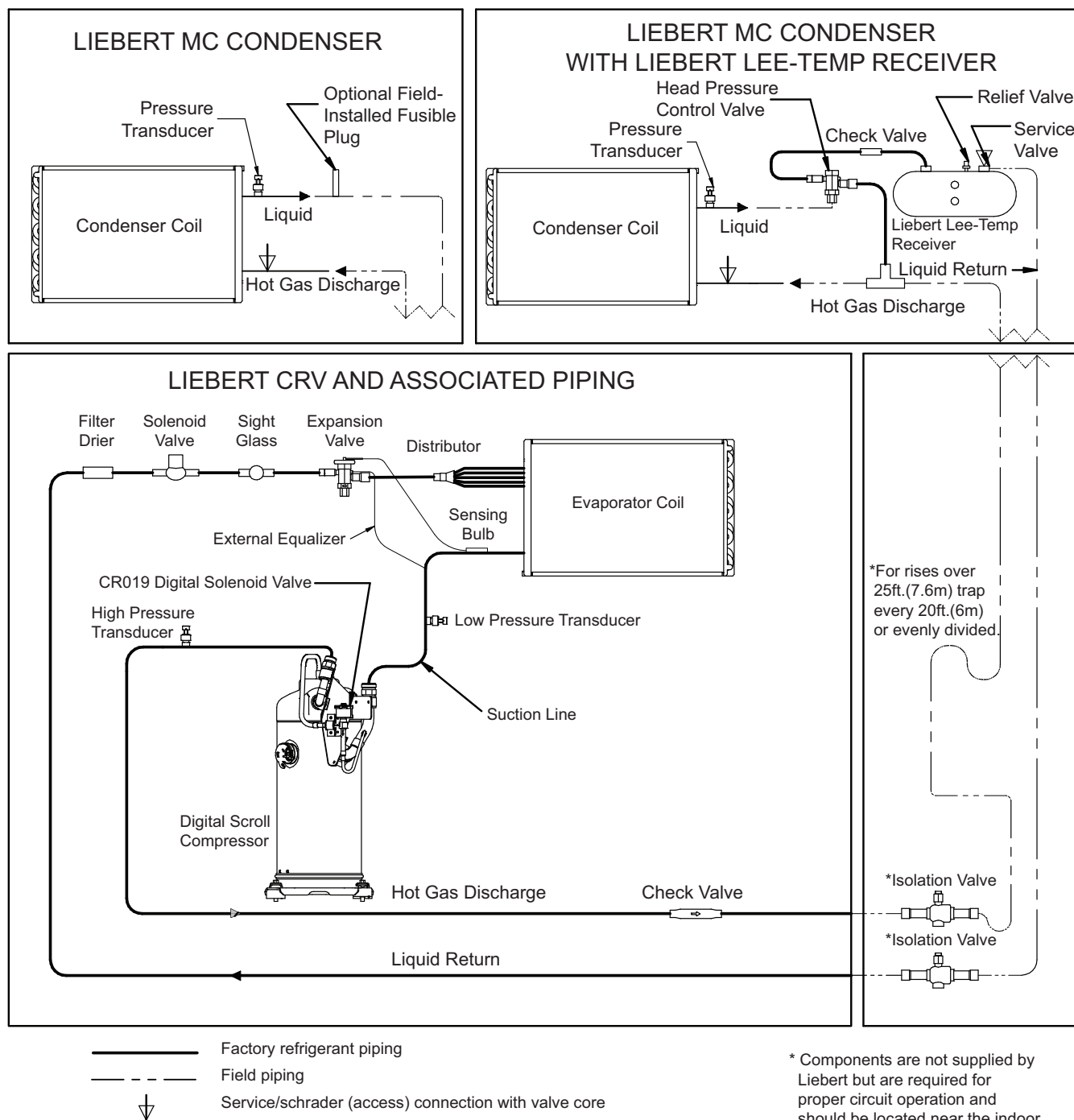
1. Schematic representation shown. Do not use for specific connection locations.
2. One or more additional pressure relief valves are required downstream of any and all field-installed isolation. Do not isolate any refrigerant circuits from overpressurization protection.

* Components are not supplied by Emerson, but are required for proper circuit operation and maintenance. Should be located near the Liebert CRV.

+ Inverted trap discharge and liquid lines to extend above the base of the coil a minimum of 7-1/2" (190mm).

DPN001984
Rev. 5

Figure 19 General arrangement, Liebert MC condenser with and without Liebert Lee-Temp™ —Air-cooled 300mm (12in.) units



NOTES:

1. Schematic representation shown. Do not use for specific connection locations.
2. One or more additional pressure relief valves are required downstream of any And all field-installed isolation. Do not isolate any refrigerant circuits from Overpressurization protection.
3. Refer to outdoor condenser documents above for proper trap placement.

DPN002808
Rev. 2

3.9 Sound Data—Air-Cooled Systems

Tables 9 and 10 show the sound pressure level in free field at 5ft. (1.5m) high and 6-1/2ft. (2m) in front of the air conditioner, with compressor and fan in operation. The sound data is without the Low Sound Package compressor jacket and sound-deadening panel insulation installed.

Sound power is an absolute measurement that can be used for comparisons when all sound measurement parameters match exactly.

Table 9 Sound data—Model CR020RA, 600mm (24in.) air-cooled

2 Fans with Filter			Sound Power Level (PWL)										Sound Pressure Level (SPL)
Fan Speed %	Airflow		Octave Band Frequency (Hz)									A-Scale Weighted dB (A)	At Suction Side, 2m Distance, Free Field Conditions (2m, f.f, dBA)
	SCFM	m³/h	31.5 dB	63 dB	125 dB	250 dB	500 dB	1000 dB	2000 dB	4000 dB	8000 dB		
100	2454	4170	73.8	69.4	71	77.3	75.9	74.2	73.5	68.2	59.2	79.6	69.2
75	2166	3680	71.2	66.8	68.4	74.7	73.3	71.6	70.9	65.6	56.6	77	66.9
55	1780	3025	67.6	63.2	64.8	71.1	69.7	68	67.3	62	53	73.4	63.9

Table 10 Sound data—Model CR035RA, 600mm (24in.) air-cooled

2 Fans with Filter			Sound Power Level (PWL)										Sound Pressure Level (SPL)
Fan Speed %	Airflow		Octave Band Frequency (Hz)									A-Scale Weighted dB (A)	At Suction Side, 2m Distance, Free Field Conditions (2m, f.f, dBA)
	SCFM	m³/h	31.5 dB	63 dB	125 dB	250 dB	500 dB	1000 dB	2000 dB	4000 dB	8000 dB		
100	3260	5540	76	76.2	80.5	82.7	77.3	73.1	74.5	69	61.9	80.9	70
75	2708	4600	71.3	71.5	75.8	78	72.6	68.4	69.8	64.3	57.2	76.2	65.7
50	2048	3480	66.3	66.5	70.8	73	67.6	63.4	64.8	59.3	52.2	71.2	61.9

Table 11 Sound data—CR019RAS, 300mm (12in.) DX, air-cooled and water/glycol cooled

5 Fans with Filter			Sound Power Level (PWL)											Sound Pressure Level (SPL)		
Fan Speed %	Airflow		Octave Band Frequency (Hz)									A-Scale Weighted dB(A)	Inlet dB(A)	Outlet dB(A)	At Suction Side, 2m Distance, 1.5m Above Ground, Free Field Conditions (2m, f.f, dBA)	At Discharge Side, 2m Distance, 1.5m Above Ground, Free Field Conditions (2m, f.f, dBA)
	SCFM	m³/h	31.5 dB	63 dB	125 dB	250 dB	500 dB	1000 dB	2000 dB	4000 dB	8000 dB					
100	2610	4435	—	—	72.2	82.3	81.5	81.2	78.1	70.2	64.7	85.4	76.7	82.6	65.7	71.6
75	2216	3765	—	—	69.7	79.0	79.1	77.4	73.9	65.9	62.3	81.6	72.7	79.9	61.8	68.9
50	1615	2744	—	—	71.1	66.1	67.2	65.1	59.5	55.2	51.8	69.4	62.0	70.2	51.0	59.2

1. Normal operation of unit at 208- 230V/3ph/60Hz

3.10 Standard Features—600mm (24in.) Air-Cooled Systems

Source: DPN001904, Rev. 3

DX Cooling Coil—The evaporator coil has 7.25 ft² (0.674 m²) face area, four or five rows deep. It is constructed of copper tubes and hydrophilic coated aluminum fins. The hydrophilic coating provides superior water carryover resistance. Two stainless steel condensate drain pans are provided.

Refrigeration System—Single refrigeration circuit includes a liquid line filter dryer, a refrigerant sight glass with moisture indicator, an adjustable, externally equalized expansion valve and a liquid line solenoid valve.

Compressor—The compressor is an R-410A scroll-type with variable capacity operation from 20-100%; commonly known as a *digital scroll*. The compressor solenoid valve unloads the compressor to provide variable capacity operation. The compressor has a suction gas-cooled motor, vibration isolators, internal thermal overloads, manual reset high-pressure switch, rotalock service valves, low-pressure and high-pressure transducer, crankcase heater, internal centrifugal oil pump and an operating speed of 3500rpm @ 60Hz (2900rpm @ 50Hz).

Fan—The unit is equipped with two plug fans: Direct-drive fans with backward-curved blades and electronically commutated DC motors; commonly referred to as *EC plug fans*. The fan speed is variable and automatically regulated by the Liebert iCOM[®] through all modes of operation. Each fan has a dedicated motor and speed controller that provide a level of redundancy. The fans are located on the rear panel of the unit and push air through the coil.

Supply Air Baffle—A field-adjustable, modular supply air baffle is located in the discharge air stream. It can be quickly and easily configured to redirect airflow. The angles of the vanes have been optimized to effectively distribute air to heat-generating equipment in a wide variety of applications.

Liebert iCOM Control System—The Liebert CRV is controlled by the Liebert iCOM. The standard user interface is the Large Graphical Display (320x240 pixels, backlit), which presents system information and allows all parameters to be viewed and adjusted. It features push-button navigation, operational status LEDs and a three-level password protection system. Unit-to-Unit communication with other Liebert CRV's and two Liebert IntelliSlot[™] communication card housings are included as standard.

2T Rack Temperature Sensors—Each consists of a vented case with two temperature probes. Three 2T rack sensors are standard with each Liebert CRV. Up to ten 2T housings (20 temperature probes) can be connected to a Liebert CRV. One 2T housing and both sensor probes are to be attached to a rack the Liebert CRV is cooling. The sensors provide real-time, direct feedback to the cooling unit to optimize the amount of cooling and airflow required, increasing energy efficiency and ensuring proper rack inlet air temperatures. The sensor data can also be reported to remote BMS and monitoring systems. The sensor network consists of one CAN wire leaving the cooling unit and connecting to a 2T sensor. Each remaining 2T sensor is connected to the previous sensor in a daisy-chain configuration.

Remote Shutdown Terminal—Provides a remote location to shut down the unit.

Common Alarm Contact—Provides a set of normally open (N/O) contacts for remote indication of unit alarms.

Cabinet—The exterior steel panels are custom powder-coated to protect against corrosion. The double-wall side panels separate the half-inch, 2.0 lb/ft³ insulation from the airstream. The unit is mounted on casters for quick installation and provided with leveling feet. The perforated inlet and outlet panels have 81% open area. The rear door utilizes a Knürr rack style handle and hinges.

Service Access—All service and maintenance is performed through the front or rear of the unit; including any component removal. No side access is required. All electrical and piping connections are made through the top and/or bottom of the unit. All units are provided with a superior service access panel to provide additional access.

Filter—The unit is equipped with two deep-pleated, four-inch filters rated MERV8 (based on ASHRAE 52.2-2007), located within the cabinet, and accessible from the rear of the unit. A filter clog alarm is included.

Locking Disconnect Switch—A molded case circuit interrupter disrupts the flow of power to the unit. The electric panel high-voltage compartment can be accessed only with the switch in the Off position. The switch is located behind the Liebert iCOM display door for quick access.

65,000A Short Circuit Current Rating (SCCR)—The electrical panel provides a 65k amp SCCR.

3.11 Optional Features—600mm (24in.) Air-Cooled Systems

Source: DPN001907, Rev. 3

Dual-Float Condensate Pump—It has a capacity of 6 GPM (22.7 l/m) at 30ft. (9m) head. Pump is complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.

Humidifier—A steam generating canister humidifier is factory-installed in the cooling unit and is operated by the Liebert iCOM® control system. It is complete with disposable cylinder, all supply and drain valves, steam distributor and electronic controls. The need to change the canister is indicated on the Liebert iCOM display. The humidifier is designed to operate with water conductivity from 125-500 (50Hz) or 330-670 (60Hz) microS/cm. System automatically fills and drains as well as maintains the required water level based on conductivity. An air-gap within the humidifier assembly shall prevent back-flow of the humidifier supply water. The humidifier is removable from the rear of the cabinet.

Electric Reheat—The electric reheat coils are low watt density, 304 stainless steel fin-tubular construction, protected by thermal safety switches and controlled in one stage.

Low Noise Package—The Low Noise Package reduces the level of sound emitted from the compressor. The package consists of a 3/8 inch closed-cell polymeric 4.5 – 8.5 lb/ft³ density compressor sound jacket that encloses the compressor. Additional half-inch closed cell polymeric 3 - 8 lb/ft³ density sound deadening material is affixed to the underside of the superior service access panel located above the compressor and attached to the inner side of the compressor compartment panels that face the hot and cold aisles. All sound deadening material is non-shedding and is outside of the airstream.

Liebert IntelliSlot™ Unity-DP—Provides ground fault isolated connectivity for unit monitoring and management. Supported management interfaces include:

- Emerson Protocol for Trellis™, Liebert SiteScan™ and Liebert Nform™
- Embedded LIFE™ Technology for Remote Service Delivery
- SNMP (v1/v2c/v3) for Network Management Systems
- HTTP/HTTPS for Web page viewing
- SMTP for e-mail
- SMS for mobile messaging
- Modbus RTU—Modbus Remote Terminal Unit (RTU) communication protocol for Building Management Systems over an RS-485 serial network (also called Modbus RTU RS-485)
- Modbus TCP—Modbus Transmission Control Protocol for Building Management Systems over an Internet or LAN network
- BACnet IP—BACnet over Internet Protocol for Building Management Systems over a Internet or LAN network
- BACnet MSTP—BACnet Master-Slave/Token-Passing (MSTP) communication protocol over an RS-485 serial network (also called BACnet MSTP RS-485)

Liebert IntelliSlot SiteLink-E® CARD (IS-485EXI)—Provides ground fault isolated connection to a Liebert SiteLink-E for monitoring and management. Compatible with Liebert SiteScan® Web 4.0 or newer version.

Filter—The optional filters are two deep-pleated, four-inch filters rated MERV11 following ASHRAE 52.2 (60-65% by ASHRAE 52.1), located within the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

Reheat / Humidifier Lockout—Includes the necessary relays to disable the reheat and humidifier from an external 24V signal.

One (1) Extra Common Alarm Contact—Provides two sets of normally open (N/O) contacts for remote indication of unit alarms.

Liebert Liqui-tect® Sensor—This solid-state water sensor has no moving parts and is hermetically sealed to keep out dust and dirt. The alarm system is activated when the sensor detects the presence of moisture.

3.12 Standard Features—300mm (12in.) Air-Cooled Systems

Source: DPN002811, Rev. 5

DX Cooling Coil—The evaporator coil has 6.46 ft² (0.60 m²) face area, three rows deep. It is constructed of copper tubes and hydrophilic coated aluminum fins. The hydrophilic coating provides superior water carryover resistance. A stainless steel condensate drain pan is provided.

Refrigeration System—Single refrigeration circuit includes a liquid line filter dryer, a refrigerant sight glass with moisture indicator, an adjustable externally equalized expansion valve and a liquid line solenoid valve.

Compressor—The compressor is an R-410A scroll-type with variable capacity operation from 20-100%, commonly known as a *digital scroll*. Compressor solenoid valve unloads the compressor to provide variable capacity operation. The compressor has a suction gas-cooled motor, vibration isolators, internal thermal overloads, manual reset high pressure switch, rotalock service valves, low pressure and high pressure transducer, crankcase heater, internal centrifugal oil pump and an operating speed of 3500 rpm @ 60Hz (2900rpm @ 50Hz).

Fans—The unit is equipped with five plug fans: direct driven centrifugal fans with backward-curved blades and electronically commutated motors, commonly referred to as *EC plug fans*. The fan speed is variable and automatically regulated by the Liebert iCOM[®] through all modes of operation. Each fan has a dedicated motor and integrated speed controller that provides a level of redundancy. The fans are in the front of the unit and pull air through the coil.

Supply Air Baffle—Field-adjustable, modular supply air baffles are located in the discharge air stream. They can be quickly and easily reconfigured to redirect airflow.

Liebert iCOM—The Liebert CRV is controlled by the Liebert iCOM. The standard user interface is the Large Graphical Display (320x240 pixels, backlit), which presents system information and allows all parameters to be viewed and adjusted. It features push-button navigation, operational status LED's and a three-level password protection system. Unit-to-Unit communication with other Liebert CRV's and two Liebert IntelliSlot[™] communication card housings are included as standard.

2T Rack Temperature Sensors—Each consists of a vented case with two temperature probes. Three 2T rack sensors are standard with each Liebert CRV. Up to ten 2T housings (20 temperature probes) can be connected to a Liebert CRV300. One 2T housing and both sensor probes are to be attached to a rack that the Liebert CRV is conditioning. The sensors provide real-time, direct feedback to the cooling unit to optimize the amount of cooling and airflow required, increasing energy efficiency and ensuring proper rack inlet air temperatures. The sensor data can also be relayed to remote BMS and monitoring systems. The sensor network consists of one CAN wire leaving the cooling unit and connecting to a 2T sensor. Each remaining 2T sensor is connected to the previous sensor in a daisy-chain configuration.

Remote Shutdown Terminal—Provides a location to shut down the unit remotely.

Common Alarm Contact—Provides a set of normally open (N/O) contacts for remote indication of unit alarms.

Cabinet—The exterior steel panels are custom powder-coated to protect against corrosion. The unit is mounted on casters for quick installation and provided with leveling feet. The perforated inlet and outlet panels have 81% open area. The front door is hinged; the rear door may be lifted off the unit.

Service Access—All service and maintenance is performed through the front and rear of the unit, including any component removal. No side access is required. All electrical and piping connections are made through the top and or bottom of the unit.

Filter—The unit is equipped with two half-inch filters rated MERV1 (based on ASHRAE 52.2-2007), inside the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

Locking Disconnect Switch—A molded case circuit interrupter disrupts the flow of power to the unit. The electric panel high-voltage compartment can be accessed only with the switch in the Off position. Located behind the rear door and filters for access.

65,000A Short Circuit Current Rating (SCCR)—The electrical panel provides a 65k amp SCCR.

3.13 Optional Features—300mm (12in.) Air-Cooled Systems

Source: DPN002812, Rev. 2

Dual-float Condensate Pump—Capacity of 45 GPH (171 l/hr) at 13 ft. (4m) head. Pump is complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.

Liebert IntelliSlot™ Sitelink-E® Card (IS-485EXI)—Provides ground fault isolated connection to a Liebert SiteLink-E for monitoring and management. Compatible with Liebert SiteScan® Web 4.0 or newer version.

Liebert IntelliSlot Unity™ Card (IS-UNITY-DP)—Provides ground fault isolated RS-485 Modbus, BACnet IP and Modbus IP network connectivity to Building Management Systems for unit monitoring and management. Also, provides ground fault isolated 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include: SNMP for Network Management Systems, HTTP for Web page viewing, SMTP for e-mail and SMS for mobile messaging. Supports dual IP and 485 protocols simultaneously.

Filter—Two optional deep-pleated filters, each 2-inch, rated MERV8 (based on ASHRAE 52.2-2007) located within the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

One (1) Extra Common Alarm Contact—Provides two sets of normally open contacts for remote indication of unit alarms.

Liebert Liqui-tect® Sensor—A solid-state water sensor hermetically sealed to keep out dust and dirt. The alarm system is activated when the sensor detects moisture.

4.0 HEAT REJECTION—LIEBERT MC™ AND FIN/TUBE CONDENSERS

All Liebert condensers are designed to work with the Liebert CRV.

4.1 Liebert MC Condenser Selections—600mm (24in.) and 300mm (12in.) CRV Units

For best performance, lowest sound and most energy-efficient operation, Emerson recommends matching a Liebert CRV 20kW or 35kW air-cooled unit with a Liebert MC condenser. The Liebert MC provides greater heat rejection and lower condensing temperatures than the legacy fin-tube condenser match-ups shown below.

Table 12 Traditional open room 95°F (35°C)/23RH return air conditions

Indoor Model	Unit Width	Outdoor Design Ambient Temperature, °F (°C)					
		95 (35)	100 (38)	105 (41)	110 (43)	115 (46)	120 (49)
CR019RA	300mm (12in.)	MCS028E1	MCM040E1	MCM040E1	MCM040E1	MCL055E1	MCL055E1
CR020A	600mm (24in.)						
CR035A		MCM040E1	MCL055E1	MCL055E1	MCM080E1	MCM080E1	MCM080E1

* 300mm (12in.) DX model

Table 13 Traditional open room 95°F (35°C)/23RH return air conditions, Liebert QuietLine™ operation

Indoor Model	Unit Width	Outdoor Design Ambient Temperature, °F (°C)					
		95 (35)	100 (38)	105 (41)	110 (43)	115 (46)	120 (49)
CR019RA	300mm (12in.)	MCS028E1	MCM040E1	MCL055E1	MCL055E1	MCM080E1	—
CR020A	600mm (24in.)						—
CR035A		MCL055E1	MCL055E1	MCM080E1	MCM080E1	MCL110E1	—

4.2 Dimensions and Weights—Liebert MC Condensers

Table 14 Condenser net weights, shipping weights, dimensions and volume, approximate

Model #	Domestic Packaging			Export Packaging		
	Packaged Weight, lb (kg)	Dimensions (LxWxH), in. (cm)	Volume ft ³ (m ³)	Packaged Weight, lb (kg)	Dimensions (LxWxH), in. (cm)	Volume ft ³ (m ³)
MCS028	335 (152)	76x36x63 (193x91x160)	100 (2.8)	455 (206)	77x37x64 (196x94x163)	106 (3.0)
MCM040	410 (186)	76x36x63 (193x91x160)	100 (2.8)	535 (243)	77x37x64 (196x94x163)	106 (3.0)
MCM080	750 (340)	136x36x63 (345x91x160)	179 (5.0)	945 (429)	137x37x64 (348x94x163)	188 (5.3)
MCL055	525 (238)	76x36x63 (193x91x160)	100 (2.8)	645 (293)	77x37x64 (196x94x163)	106 (3.0)
MCL110	910 (413)	136x36x63 (345x91x160)	179 (5.0)	1110 (503)	137x37x64 (348x94x163)	188 (5.3)

Weights are based on units with EC fans, units with AC fans may be slightly less.

Net and packaged weights will increase with factory options: legs taller than 18", coated coils and seismic options.

Field-installed receivers also add to net weights. Consult factory for additional information. See **Table 15** for weight added by longer legs.

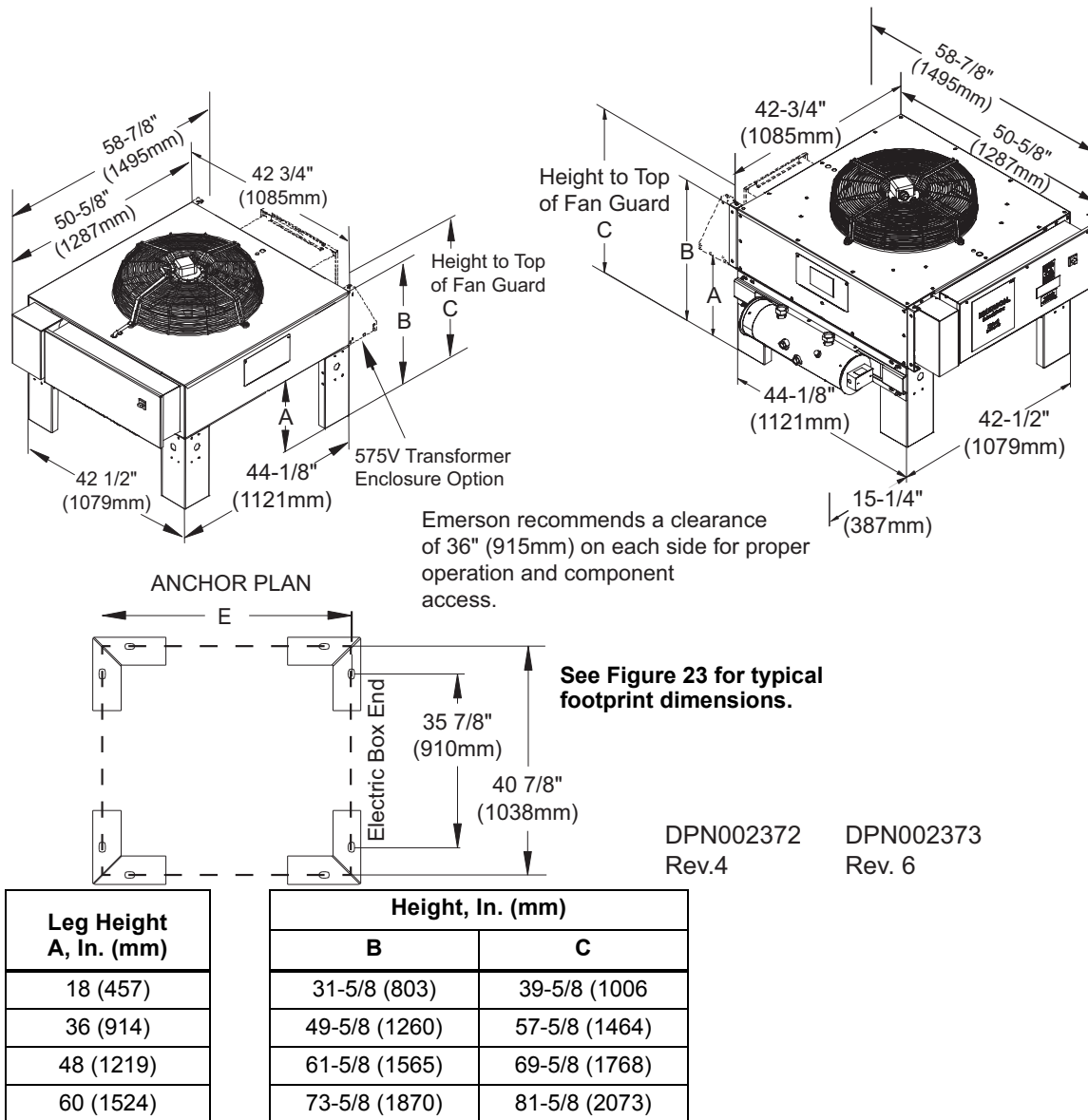
Table 15 Condenser and option weight

Leg Height In. (mm)	Additional Weight by Condenser Model, lb. (kg)						
	MCS028	MCM040	MCM080		MCL055	MCL110	
	1 Circuit	1 Circuit	1 Circuit	2 Circuits	1 Circuit	1 Circuit	2 Circuits
18 (457)	154 (70)	231 (105)	441 (200)	441 (200)	344 (156)	602 (273)	602 (273)
36 (914)	286 (130)	363 (165)	590 (268)	590 (268)	486 (220)	766 (347)	766 (347)
48 (1219)	318 (144)	395 (179)	622 (282)	622 (282)	518 (235)	798 (362)	798 (362)
60 (1524)	349 (158)	426 (193)	653 (296)	653 (296)	549 (249)	829 (376)	829 (376)
Liebert Lee-Temp Receiver	55 (25)	55 (25)	100 (45)	110 (50)	60 (27)	115 (52)	120 (54)
Coated Coil	4 (2)	5 (2)	10 (5)	10 (5)	8 (4)	16 (7)	16 (7)

Condenser + Liebert Lee-Temp + Coated Coil = Total Weight

Source: DPN003034, Rev. 0

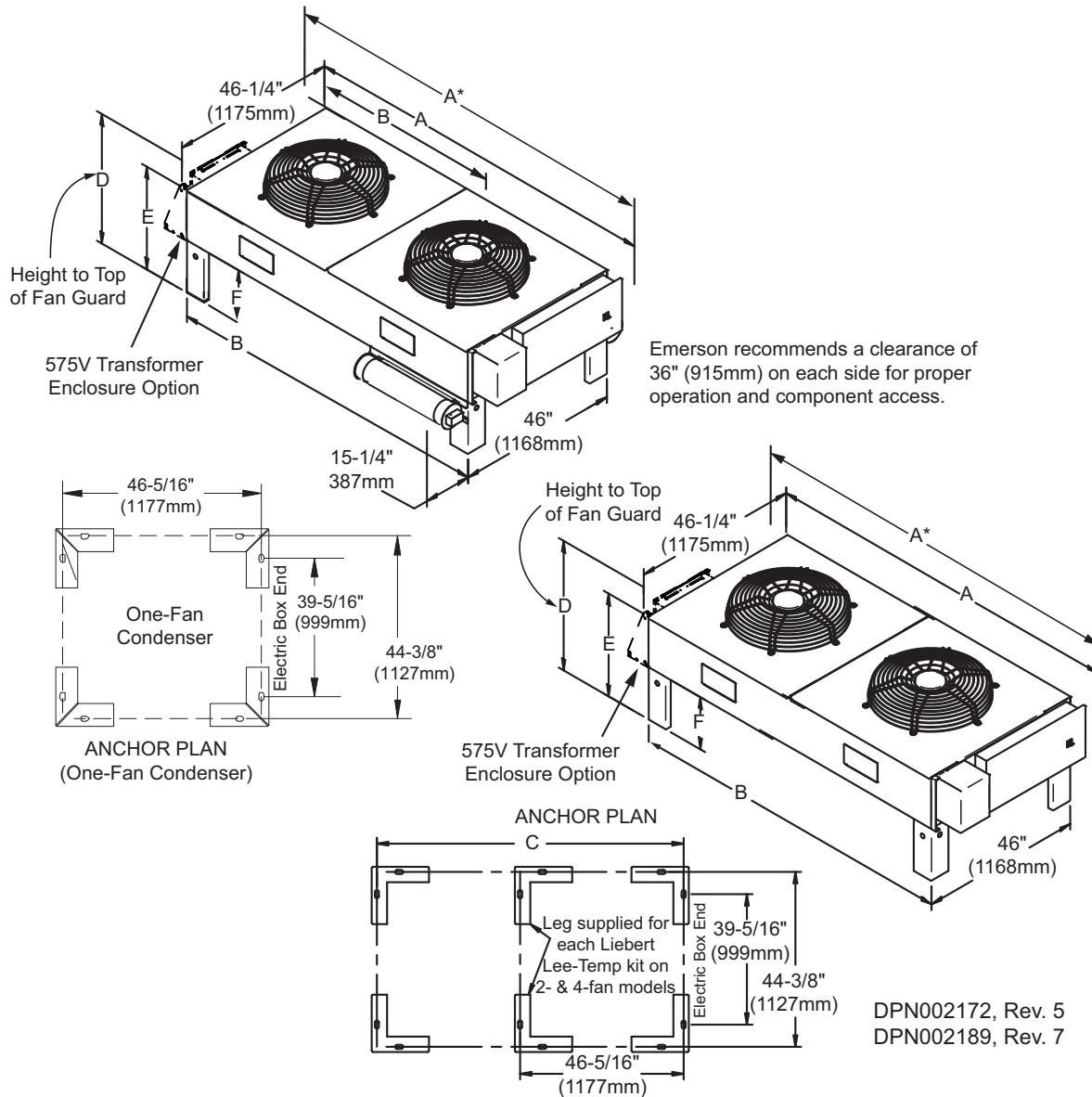
Figure 20 Condenser planning dimensional data—MCS028



* 18" legs standard for all models. Cross-bracing is required for legs longer than 18" (457mm).
Number varies according to model and options.

See **Tables 14** and **15** for weights, including added weight for legs of various lengths.

Source: DPN002372, Rev. 2; DPN002373, Rev. 6

Figure 21 Condenser planning dimensional data—MCM040, MCM080

Model #	# of Fans	Dimensions, In. (mm)			
		A In. (mm)	A* (575V) In. (mm)	B In. (mm)	C In. (mm)
MCM040	1	57-3/16 (1453)	65-3/8 (1661)	48 (1219)	46-5/16 (1177)
MCM080	2	105-1/4 (2674)	113-7/16 (2882)	96-1/16 (2440)	94-7/16 (2398)

* 18" legs standard for all models. Cross-bracing is required for legs longer than 18" (457mm); number varies according to model and options.

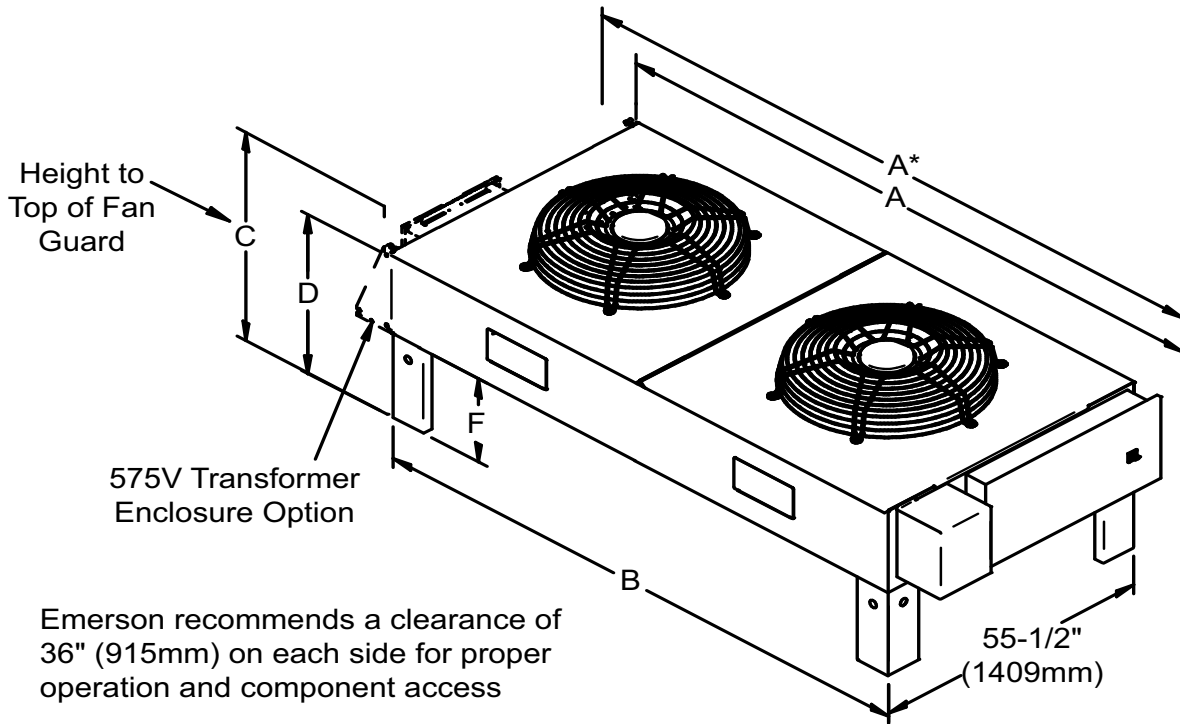
See **Tables 14** and **15** for weights, including added weight for legs of various lengths.

Source: DPN002172, Rev. 5; DPN002189, Rev. 7

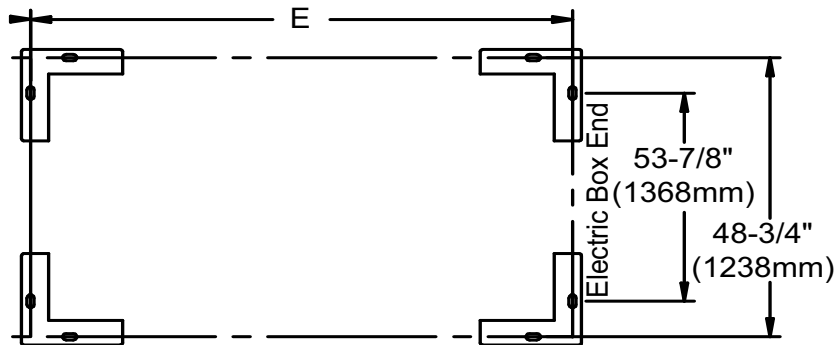
Model #	Height, In. (mm)		Leg Height, In. (mm)
	D	E	F
MCM040 MCM080	39-5/8 (1006)	31-5/8 (803)	18 (457)
	57-5/8 (1464)	49-5/8 (1260)	36 (914)
	69-5/8 (1768)	61-5/8 (1585)	48 (1219)
	81-5/8 (2073)	73 5/8 (1870)	60 (1524)

Source: DPN002172, Rev. 5; DPN002189, Rev. 7

Figure 22 Condenser planning dimensional data—MCL055, MCL110



ANCHOR PLAN



See Figure 23 for typical footprint dimensions.

WEIGHT lb. (kg)

MCL055: 344 (156)

MCL110: 602 (273)

DPN002416

Rev. 4

Model #	# of Fans	Dimensions, In. (mm)		
		A	A * (575V)	B
MCL055	1	68 (1727)	76-1/8 (1935)	56 (1423)
MCL110	2	124-1/8 (3152)	132-1/4 (3360)	112-1/8 (2848)

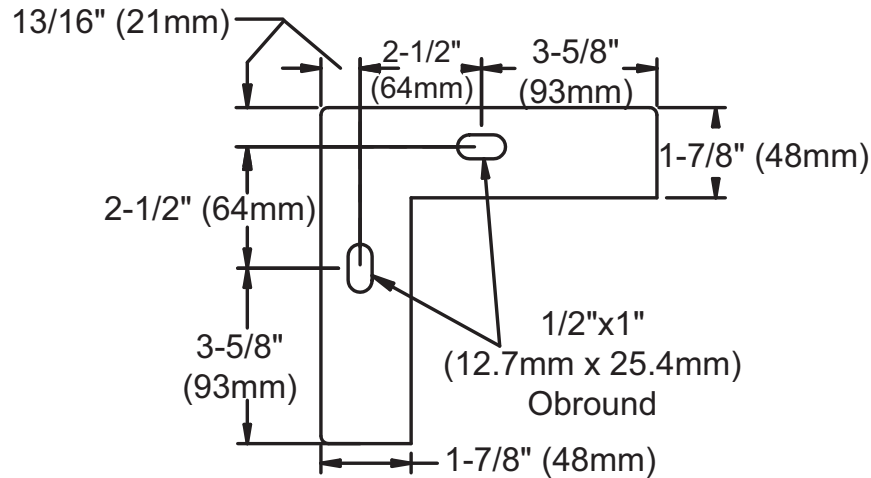
Source: DPN002416, Rev. 4

Model #	Height, In. (mm)		
	C	D	E
MCL055	43-5/8 (1108)	35-7/8 (911)	54-3/8 (1381)
MCL110	61-5/8 (1565)	53- 7/8 (1368)	110-1/2 (2806)

Source: DPN002416, Rev. 4

Leg Height F, In. (mm)
18 (457)
36 (914)
48 (1219)
60 (1524)

* Cross bracing required for legs longer than 18" (457mm); quantity varies per model and options selected

Figure 23 Typical footprint dimensions, all units

4.3 Electrical Data—Liebert MC™ Condensers

Table 16 Electrical data, three-phase, 60Hz condenser, Premium Version (EC control)

Voltage	MCS028			MCM040			MCM080			MCL055			MCL110		
	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
208/230V	3	3.8	15	2.3	3.2	15	4.6	5.5	15	5.7	7.1	15	11.4	12.8	15
460V	1.4	1.8	15	1.4	1.9	15	2.8	3.3	15	2.8	3.5	15	5.6	6.3	15
575V	1.2	1.5	15	1.2	1.6	15	2.3	2.8	15	2.3	2.9	15	4.7	5.3	15

1. FLA = Full Load Amps; WSA = Wire Size Amps; OPD = Maximum Overcurrent Protection Device.
2. 208V–460V premium models must be connected to wye 3-phase systems with solidly grounded neutral.

Table 17 Electrical data—Liebert Lee-Temp receiver, 60Hz

Rated Voltage - Single- Phase	120		200/208/230	
Watts/Receiver	150	300	150	300
Full Load Amps	1.4	2.8	0.7	1.4
Wire Size Amps	1.8	3.5	0.9	1.8
Maximum Overcurrent Protection Device, Amps	15	15	15	15

**NOTE**

Liebert Lee-Temp condensers require a separate line voltage electrical supply for the heated receivers. See **Table 16** for power requirements.

4.4 Electrical Field Connections—Liebert MC™ Condensers

Condenser-rated voltage should be verified with available power supply before installation. Refer to the unit's electrical schematic and serial tag for specific electrical requirements.

Line voltage electrical service is required for all condensers at the location of the condenser. The voltage supply to the condenser may not be the same voltage supply as required by the indoor unit. Consider using UPS equipment on both data center cooling units and Liebert MC condensers to maintain uninterrupted cooling capability. Refer to the unit's serial tag for specific condenser electrical requirements. A unit disconnect is standard. However, a site disconnect may be required per local code to isolate the unit for maintenance. Route the supply power to the site disconnect switch and then to the unit. Route the conduit to the knockout provided in the bottom right end of the electrical control enclosure. Connect the earth ground wire lead to the marked earth ground connection terminal provided near the factory-installed disconnect switch (see **Figure 24**).



NOTE

*Liebert Lee-Temp™ kits require a separate line voltage electrical supply for the heated receivers. See **Table 17** for power requirements.*

4.4.1 Electrical Field Connection Descriptions, Liebert MC Condensers

Key Electrical Details—Typical Connections, Premium Efficiency Control

Source: DPN002169, Rev. 7

1. **Three-Phase Electrical Service**—Terminals are on top of disconnect switch for one-fan and two-fan units. Terminals are on bottom of disconnect switch for three-fan and four-fan units. Three-phase service not by Emerson. See **Note 5**.
2. **Earth Ground**—Field lug terminal for earth ground connection. Ground terminal strip for fan motor ground connection.
3. **Primary High-Voltage Entrance**—Two knockouts, each 7/8" (22.2mm) diameter, at the bottom of the enclosure.
4. **SPD Field Connection Terminals**—High-voltage surge protective device (SPD) terminals. SPD is an optional device.
5. **CANbus Terminal Connections**—Field terminals for CANbus cable connection (see **Figures 24** and **25**).
 - 5A is the CANbus connectors.
 - TB49-1 is the input terminal for CANbus high.
 - TB49-3 is the input terminal for CANbus low.
 - TB50-1 is output terminal for CANbus high.
 - TB50-3 is the output terminal for CANbus low.
 - Each CANbus cable shield is connected to terminal "SH", **Item 9**.
 - 5B is the "END OF LINE" jumper.
 - 5C is the CANbus "DEVICE ADDRESS DIP SWITCH". CANbus cable not by Emerson. See **Note 2**.
6. **Remote Unit Shutdown (optional)**—Replace existing jumper between terminals TB38-1 and TB38-2 with field-supplied normally closed switch having a minimum 75VA 24VAC rating. Use field-supplied Class 1 wiring.
7. **Alarm Terminal Connections**
 - a. Common Alarm Relay indicates when any type of alarm occurs. TB74-1 is common, TB74-2 is normally open and TB74-3 is normally closed. 1 Amp 24VAC is the maximum load. Use field-supplied Class 1 wiring.
 - b. Shutdown Alarm Relay indicates when condenser loses power, or when a critical alarm has occurred that shuts down the condenser unit. TB74-4 is common; TB74-5 is normally open; and TB74-6 is normally closed. 1 Amp 24VAC is the maximum load. Use field-supplied Class 1 wiring.

8. Indoor Unit Interlock and SPD Alarm terminals

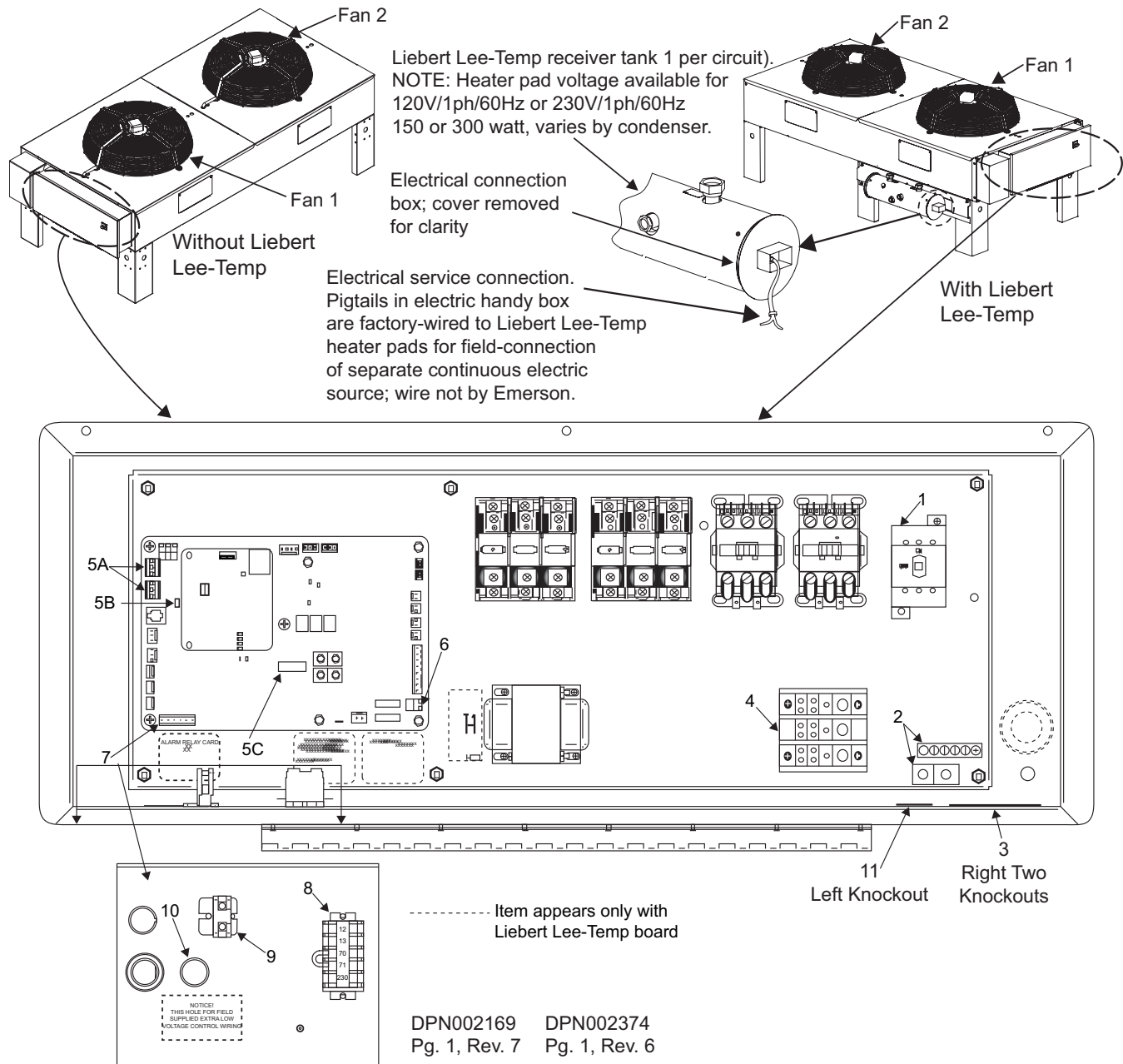
- a. On any call for compressor operation, normally open contact is closed across Terminals 70 and 71 for Circuit 1, and normally open contact is closed across Terminals 70 and 230 for Circuit 2 from indoor unit.
- b. During SPD alarm, normally open contact is closed across Terminals 12 and 13. SPD is an optional device.

9. **CANbus Shield Terminal**—Terminal for field shield connection of the CANbus field-supplied cables. The shield of CANbus field-supplied cables must not be connected to ground at the condenser.

10. **Primary Low-Voltage Entrance**—One knockout, 7/8" (22.2mm) diameter that is free for customer low-voltage wiring.

11. **SPD Entrance**—One 7/8" (22.2mm) diameter knockout hole at the bottom of the enclosure. High-voltage surge protective device (SPD) is optional.

Figure 24 Typical connections, Premium Efficiency Control



Notes to Liebert MC Condensers Electrical Field Connections

Source: DPN002169, Rev. 7

1. Refer to specification sheet for unit voltage ratings, full load amp, and wire size amp ratings.
2. The CANbus wiring is field supplied and must be:
 - Conductors 22-18AWG stranded tinned copper
 - Twisted pair (minimum four twists per foot [305mm])
 - Braided shield or foil shield with drain wire
 - Shield must be wired to ground at indoor unit
 - Low capacitance (15pF/FT or less)
 - UL-approved temperature rated to 167°F (75°C)
 - UL-approved voltage rated to 300V
 - UV-resistant and moisture-resistant if not run in conduit

Examples: Belden part number 89207(plenum rated) or Alpha Wire part number 6454 (UV-resistant outdoor rated) Category 5, 5e or higher.

3. Do not run the CANbus cable in the same conduit, raceway or chase as high voltage.
4. No special considerations are required when the total external cable connection between the indoor unit and outdoor unit(s) is less than 450FT (137M). For total external cable connections greater than 450FT (137M) but less than 800FT (243M) a CANbus isolator is required.
5. All wiring must be sized and selected for insulation case per NEC and other local codes.
6. Do not bend cables to less than four times the diameter of the cable.
7. Do not deform cables when securing in bundles or when hanging them.
8. Avoid running the cables by devices that may introduce noise, such as machines, fluorescent lights and electronics.
9. Avoid stretching cables.
10. Separate high volt wires and other high-voltage sources from CAN wires by 12 inches.
11. The electrically commutated (EC) motors included in the Liebert MC are suitable for connection to power supplies with a solidly grounded neutral. (Some platforms can accept power supplies listed under **Item** below. Contact the factory for more information.)

NOTICE

Risk of improper input power. Can cause equipment damage.

The Liebert MC Condenser Small Platform (MCS028) with Premium EC Control is designed to operate with wye-connected power. It will NOT operate properly with delta-connected power.

Acceptable Power Supplies for 208 to 575V Nominal Units

- 208V wye with solidly grounded neutral and 120V line to ground;
- 380V wye with solidly grounded neutral and 220V line to ground;
- 480V wye with solidly grounded neutral and 277V line to ground.
- 575V wye with solidly grounded neutral and 332V line to ground. (uses step-down transformer)

Non-Acceptable Power Supplies for 208V to 575V Nominal Units

- Wye with high resistance (or impedance) ground;
- Delta without ground or with floating ground;
- Delta with corner ground; or
- Delta with grounded center tap

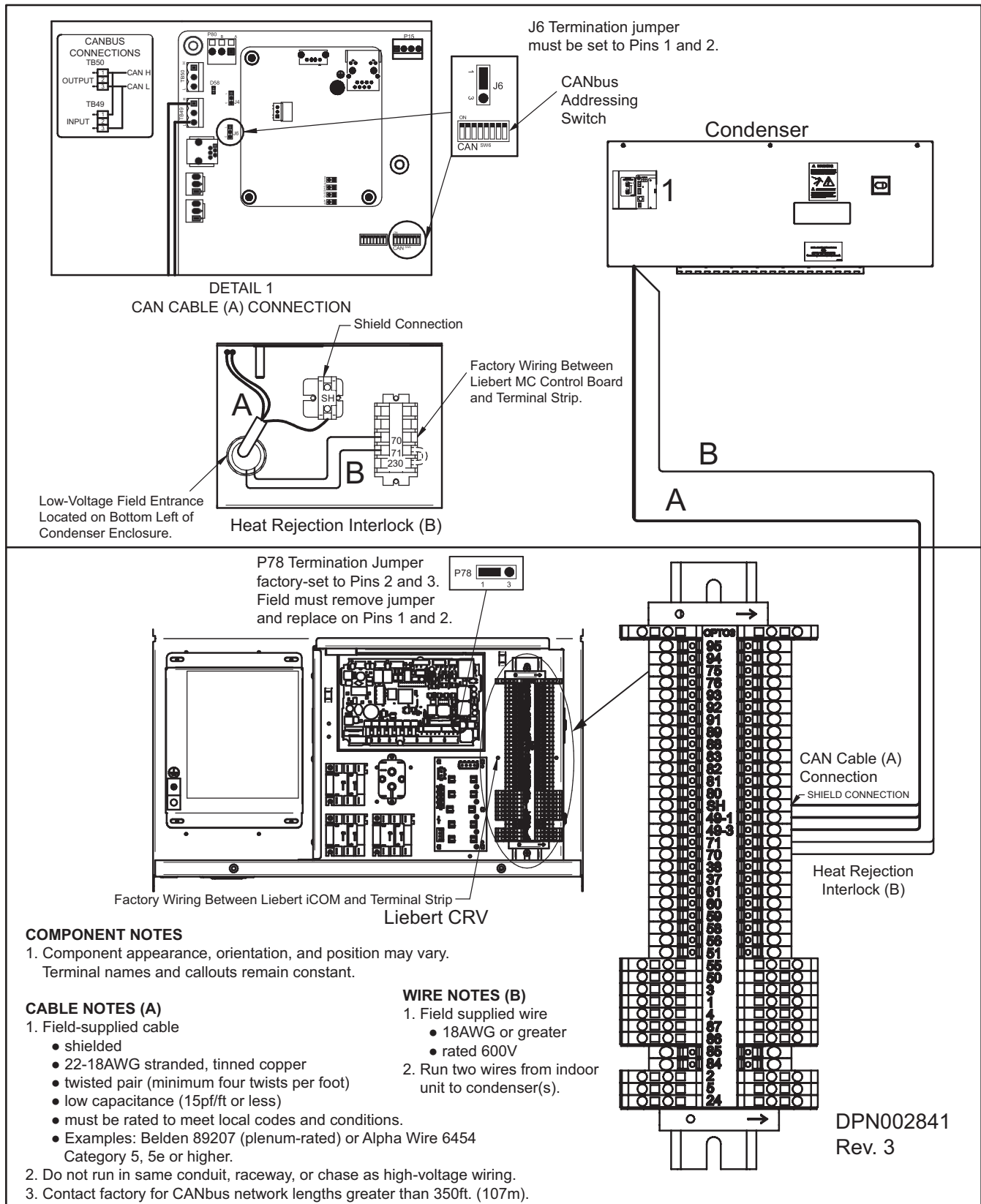
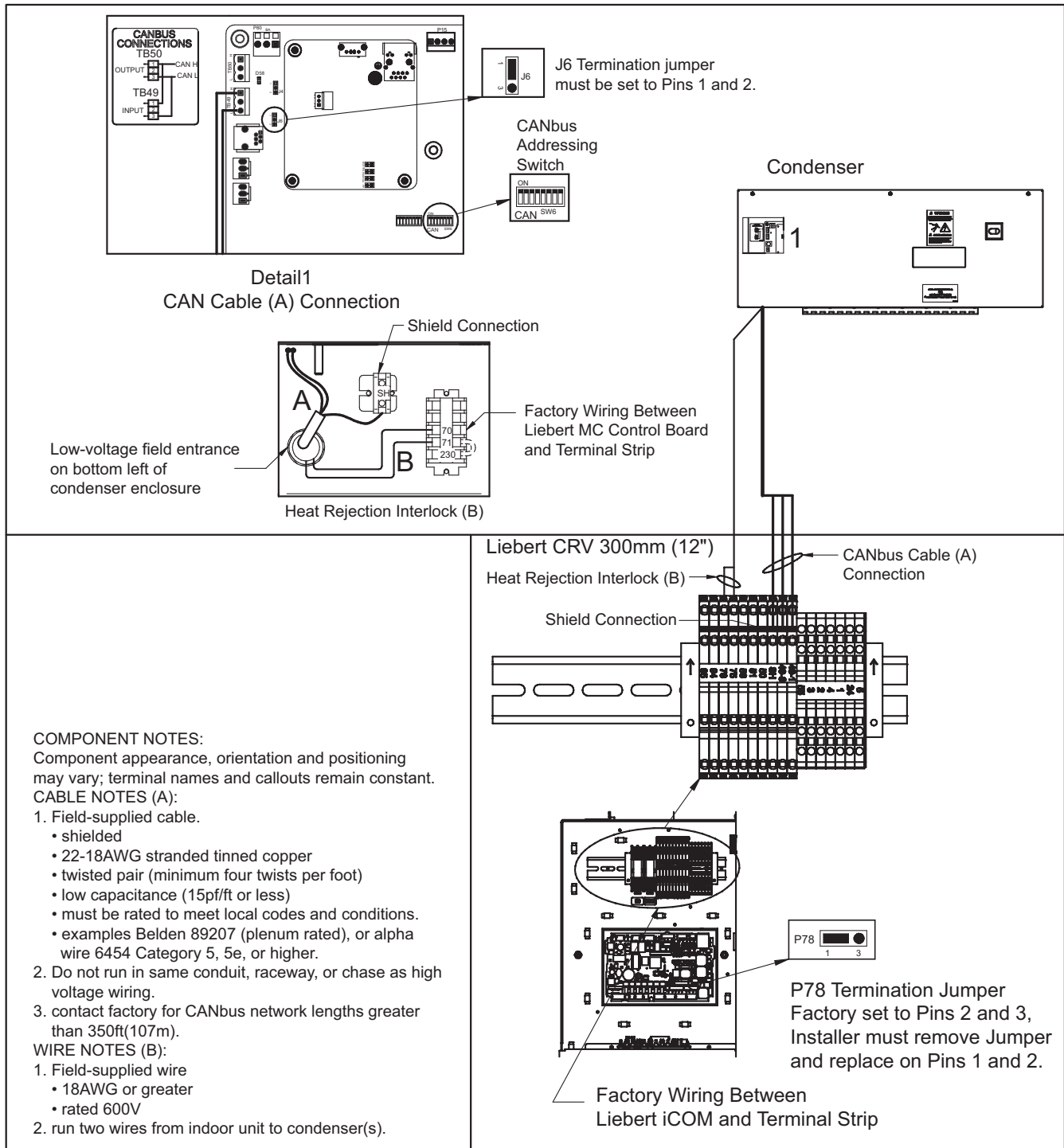
Figure 25 CANbus communication connection Liebert CRV 600mm (24 in.) and Liebert MC (premium) unit

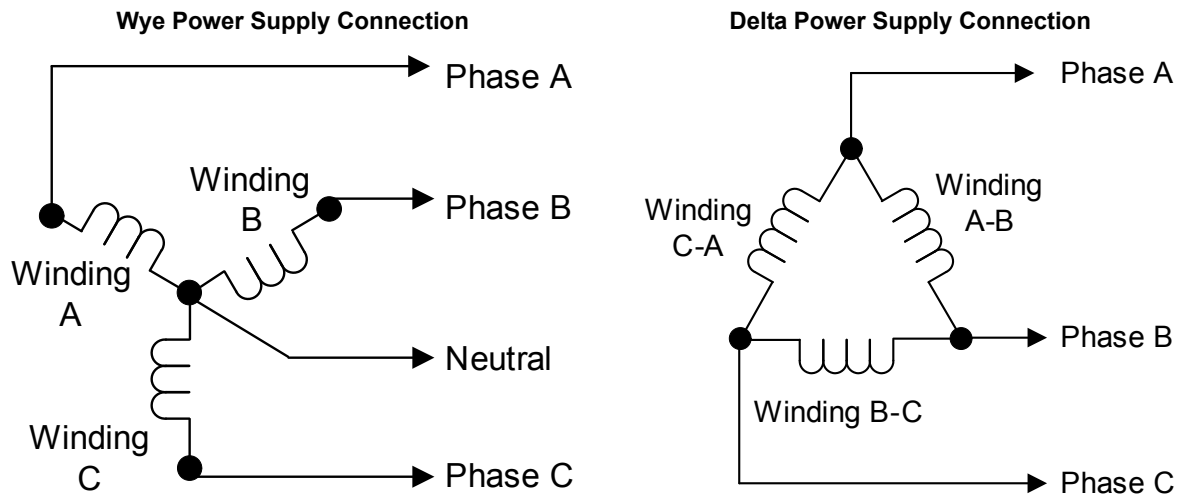
Figure 26 CANbus communication connection Liebert CRV 300mm (12 in.) and Liebert MC (premium) unit

DPN003036
Rev. 1

4.4.2 Wye vs. Delta Connection Power Supply—MCM and MCL Models with EC Fans

Condensers can operate on wye or delta connection power supply.

Figure 27 Wye and delta power supply connection diagram



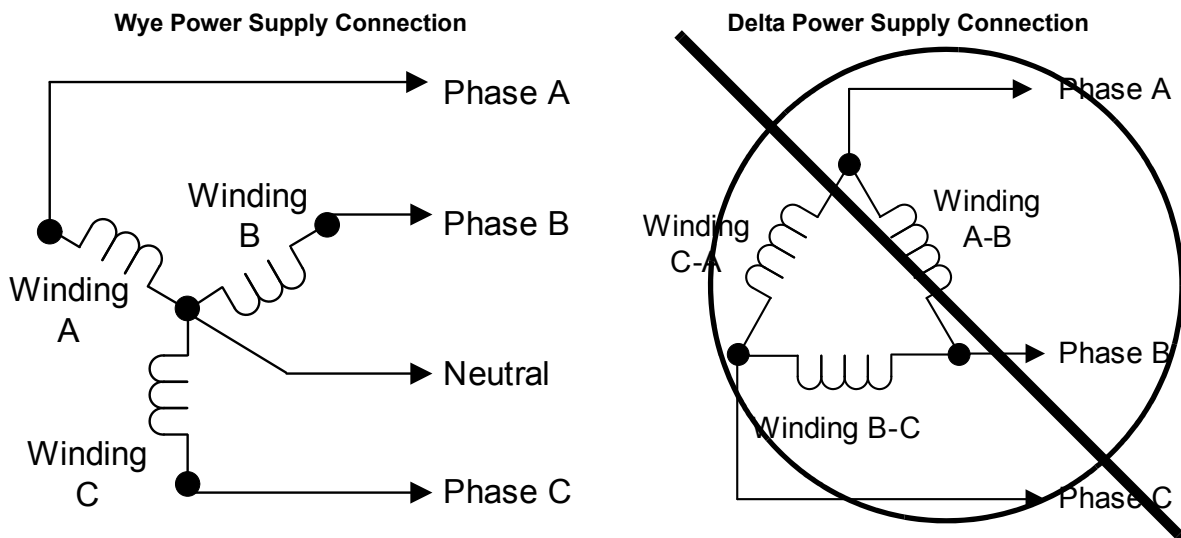
4.4.3 Wye vs. Delta Connection Power Supply—Small Platform Condenser (MCS028) with Premium EC Control

NOTICE

Risk of improper input power. Can cause equipment damage.

The Liebert MC Condenser Small Platform (MCS028) with Premium EC Control is designed to operate with wye-connected power. It will NOT operate properly with delta-connected power.

Figure 28 Wye and delta power supply connection diagram



Acceptable Power Supplies—208V to 480V Nominal Units - Small Platform Condenser (MCS028) with Premium EC Control

- 208V wye with solidly grounded neutral and 120V line-to-ground
- 380V wye with solidly grounded neutral and 220V line-to-ground
- 480V wye with solidly grounded neutral and 277V line-to-ground

Unacceptable Power Supplies—208V to 480V Nominal Units - Only Small Platform Condenser (MCS028) with Premium EC Control

- Wye with high-resistance (or impedance) ground
- Delta without ground or with floating ground
- Delta with corner ground
- Delta with grounded center tap



NOTE

The Liebert MCS028 Premium EC Fan Model will not operate properly with delta-connected power. A field-supplied isolation transformer or other power solutions will be needed to for proper condenser function.

4.5 Piping—Liebert MC™ Condensers

4.5.1 Piping Guidelines

Indoor units and condensers both ship with holding charges of inert gas. Do not vent the condenser until all refrigerant piping is in place, ready for connection to indoor unit and condenser.

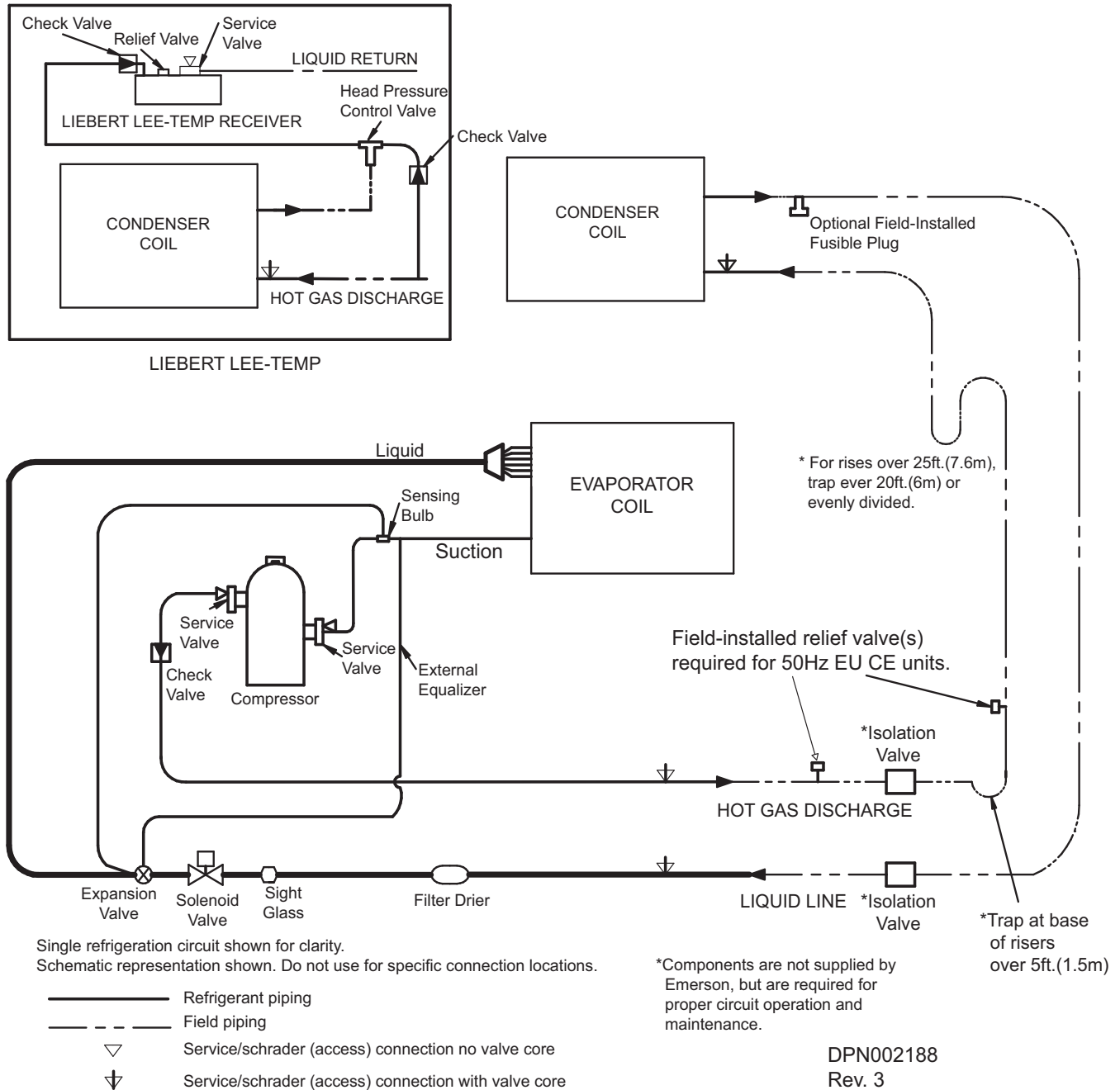
- Use copper piping with a brazing alloy with a minimum temperature of 1350°F (732°C), such as Sil-Fos. Avoid soft solders such as 50/50 or 95/5.
- Use a flow of dry nitrogen through the piping during brazing to prevent formation of copper oxide scale inside the piping. When copper is heated in the presence of air, copper oxide forms. POE oil will dissolve these oxides from inside the copper pipes and deposit them throughout the system, clogging filter driers and affecting other system components.
- A pure dry nitrogen flow of 1-3 ft³/min (0.5-1.5 l/s) inside the pipe during brazing is sufficient to displace the air. Control the flow using a suitable metering device.
- Ensure that the tubing surfaces to be brazed are clean and that the ends of the tubes have been carefully reamed to remove any burrs.
- Ensure that all loose material has been cleaned from inside the tubing before brazing.
- Protect all refrigerant line components within 18" (460mm) of the brazing site by wrapping them with wet cloth or suitable heat sink compound.
- Isolate piping from building using vibration isolating supports.
- Refer to the indoor unit's user manual for appropriate piping sizes.
- Install traps on the hot gas (discharge) lines at the bottom of any rise over 5 feet high. If the rise exceeds 25 feet (7.5m), then install a trap in 20 foot (6m) increments or evenly divided.
- Pitch horizontal hot gas piping down at a minimum rate of 1/2" per 10 ft. (42mm per 10m) so that gravity will aid in moving oil in the direction of refrigerant/oil flow.
- Consult factory if Liebert Lee-Temp™ condenser is below the evaporator or if a condenser not equipped with Liebert Lee-Temp is more than 15 ft (4.6m) below the evaporator.
- Consult factory if piping run exceeds 150 feet (46m) equivalent length on traditional DX units.
- Consult factory if piping run exceeds 300 feet (91m) actual length, or 450 feet (137m) equivalent length on units installed with Liebert EconoPhase™ units.
- Record linear length of liquid and discharge line required from the indoor unit to the condenser accurately for calculating refrigerant requirements.
- Keep piping clean and dry, especially on units with POE oil (R407C, R410A or R22 refrigerant).
- Avoid piping runs through noise-sensitive areas.
- Do not run piping directly in front of indoor unit discharge airstream.
- Refrigerant oil – do not mix oil types or viscosities. Consult indoor unit for refrigerant type and oil requirements.



NOTE

Failure to use compressor oils recommended by compressor manufacturer will void compressor warranty. Consult Emerson or the compressor manufacturer for further recommendations or if you have questions about compressor oils.

Refer to ASHRAE Refrigeration Handbook for general good practices for refrigeration piping. The Liebert indoor cooling unit has a factory-installed high-pressure safety switch in the high side refrigerant circuit. A pressure relief valve is provided with Liebert Lee-Temp™ receivers. A fusible plug is factory installed in the Liebert DSE™ receivers. Consult local building codes to determine if condensers without receivers will require field-provided pressure relief devices. A fusible plug kit is available for field installation.

Figure 29 Liebert MC piping schematic with and without Liebert Lee-Temp™

4.6 Field Piping Guidelines Liebert MC™ Condensers

One discharge line and one liquid line must be field-installed for each circuit of the indoor unit and the outdoor condenser(s). Dual circuit condensers are available for most dual circuit indoor unit applications. Refer to **Figures 29**, through **31** for additional field-installed piping needed at the condenser. This piping is needed for proper system performance and for installation/interconnecting receivers and head pressure control valves for Liebert Lee-Temp™ systems.



NOTE

Keep the evaporator unit and condenser closed with their factory charge of inert gas while all field piping is installed. Keep the field piping clean and dry during installation, and do not allow it to stand open to the atmosphere.

When all the field interconnecting piping is in place, vent the condenser's inert gas charge and connect to the field piping. Finally, vent the evaporator unit's charge of inert gas and make its piping connection last.

Keep accurate length measurements of field piping for estimating system charge.

Follow all proper brazing practices, including a dry nitrogen purge to maintain system cleanliness.

The condenser connection pipes must be wrapped with a wet cloth to keep the pressure and temperature sensors cool during any brazing.

Figure 30 Liebert MC™ Condenser piping—Single-circuit units

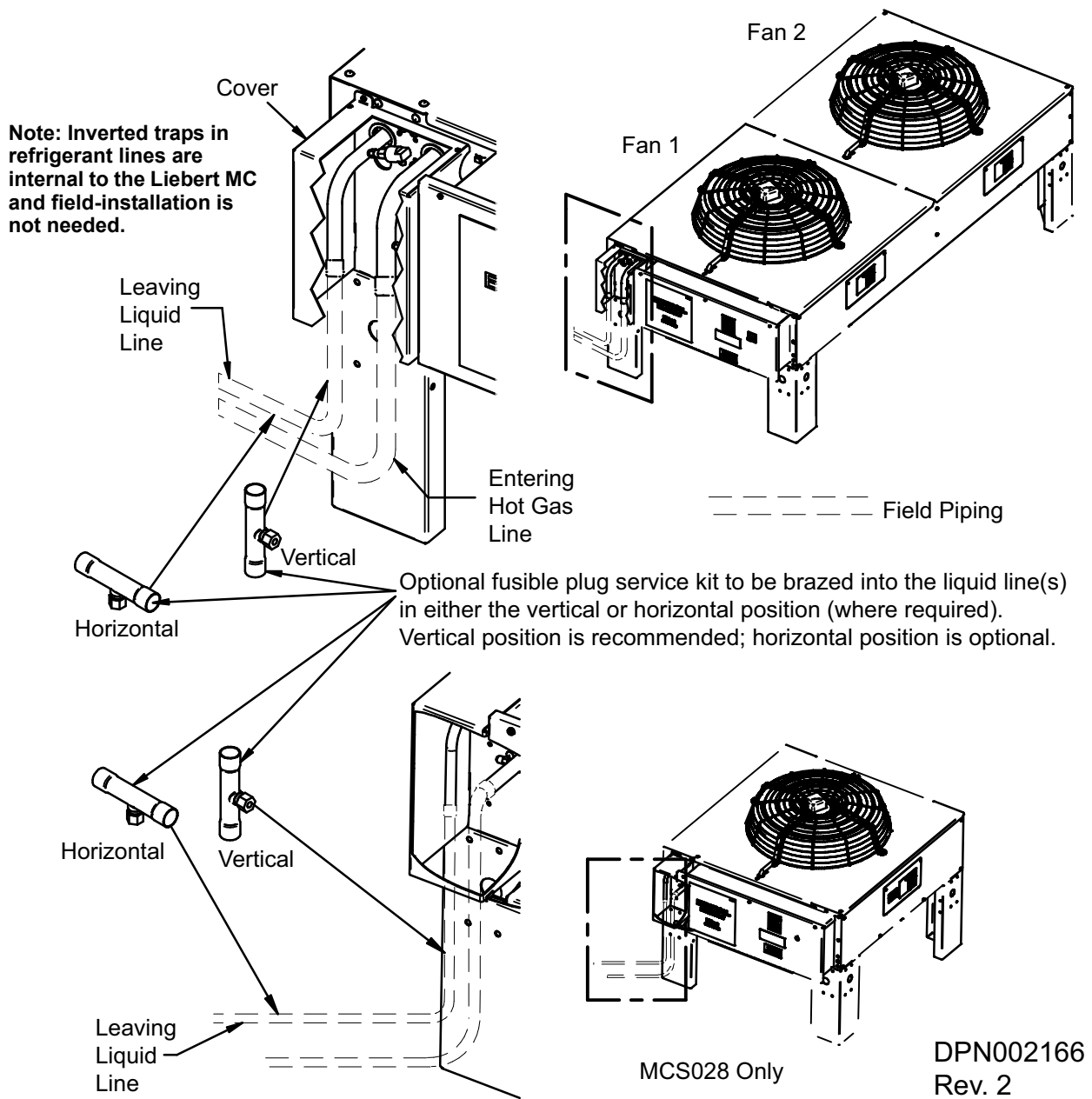
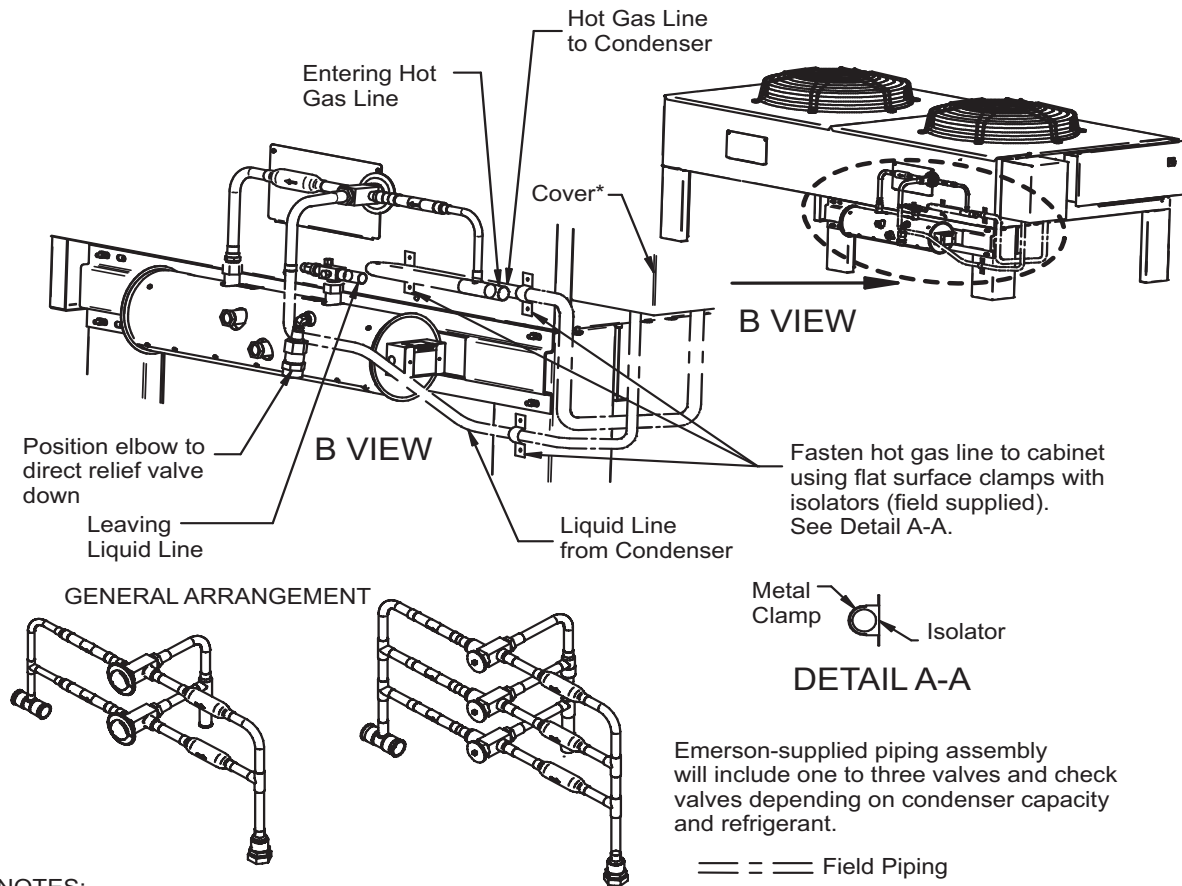


Table 18 Liebert MC single-circuit piping sizes

Model No.	Number of Fans	Connection Sizes, OD, In	
		Hot Gas Line	Liquid Line
MCS028	1	7/8	5/8
MCM040	1	7/8	5/8
MCM080	2	1-1/8	7/8
MCL055	1	1-1/8	7/8
MCL110	2	1-3/8	1-1/8

Source: DPN002166, Rev. 2

Figure 31 Condenser piping for single-circuit Liebert MC™ condensers (with Liebert Lee-Temp™)**NOTES:**

1. The following materials are supplied by Emerson, and are shipped loose for each circuit and for field installation: insulated Liebert Lee-Temp receiver tank with electric heater pads and sight glasses, piping assembly with head pressure control valve and check valve, and rotalock valve and pressure relief valve. All other piping and electrical wiring to be supplied and installed by others. Additional condenser leg per circuit when required, ships with the condenser.
2. For runs longer than 150ft. (45.7m) equivalent length, consult the factory for proper line sizing.

*Shipping cover is not necessary for proper condenser operation and may be recycled if field piping interferes with proper reattachment.

DPN002167
Rev 5

Table 19 Condenser piping connection sizes—Single-circuit condensers with Liebert Lee-Temp

Model #	Condenser Connections, OD, In.		Liebert Lee-Temp Connections		
	Hot Gas	Liquid	Hot Gas Tee IDS In.	Liquid Line to Liebert Lee-Temp Valve, ODS, In.	Receiver Out Rotalock IDS In.
MCS028	7/8	5/8	7/8	5/8	5/8
MCM040	7/8	5/8	7/8	5/8	5/8
MCM080	1-1/8	7/8	1-1/8	7/8	1-1/8
MCL055	1-1/8	7/8	1-1/8	7/8	7/8
MCL110	1-3/8	1-1/8	1-3/8	1-1/8	1-1/8

Source: DPN002167, Rev. 5

Table 20 Recommended refrigerant line sizes for Liebert MC™ condensers with R-410A, with and without Liebert Lee-Temp™, Cu, OD

Liebert CRV Model #	Total Equivalent Length, ft. (m)	Hot Gas Line, in. (m)	Liquid Line, in. (m)
CR019RA/ CR020RA	50 (15.2)	3/4 (19.1)	5/8 (15.9)
	100 (30.5)	3/4 (19.1)	5/8 (15.9)
	150 (45.7)	3/4 (19.1)	5/8 (15.9)
	300 (91.4)	7/8 (22.2) ²	3/4 (19.1)
CR035RA	50 (15.2)	7/8 (22.2)	3/4 (19.1)
	100 (30.5)	7/8 (22.2)	3/4 (19.1)
	150 (45.7)	7/8 (22.2)	3/4 (19.1)
	300 (91.4)	1-1/8 (28.6) ²	7/8 (22.2)

1. Consult factory for proper line sizing for runs longer than 300 ft. (91.4m) equivalent length.

2. Must downsize vertical riser one trade size (1-1/8" to 7/8" or 7/8" to 3/4").

4.7 Liebert Fin/Tube Condenser Selections—600mm (24in.) Units

4.7.1 Variable Frequency Drive Fin/Tube Condensers with/without Liebert Lee-Temp™

The fin/tube condensers are designed for operation in outdoor ambient temperatures ranging from -20°F to 115°F (-29 to 46°C). The Liebert Lee-Temp models provide operation in colder outdoor environments ranging from -30°F to 115°F (-34 to 46°C).

Table 21 Traditional open room return air conditions

Model No.	Unit Width	Ambient Temperature Selection			
		95°F (35°C) Standard Selection		100°F - 115° (38°C-46°C)	
		VFD Units	Units with Liebert Lee-Temp	VFD Units	Units with Liebert Lee-Temp
CR020A	600mm (24in.)	TCSV28K	DCSL28K	TCSV60K	DCSL60K
CR035A		TCSV60K	DCSL60K	TCSV90K	DCSL90K

4.8 Dimensions and Weights—Liebert Fin/Tube Condensers

Figure 32 Cabinet and anchor dimensions, R-410A single-circuit Liebert Lee-Temp™ condensers

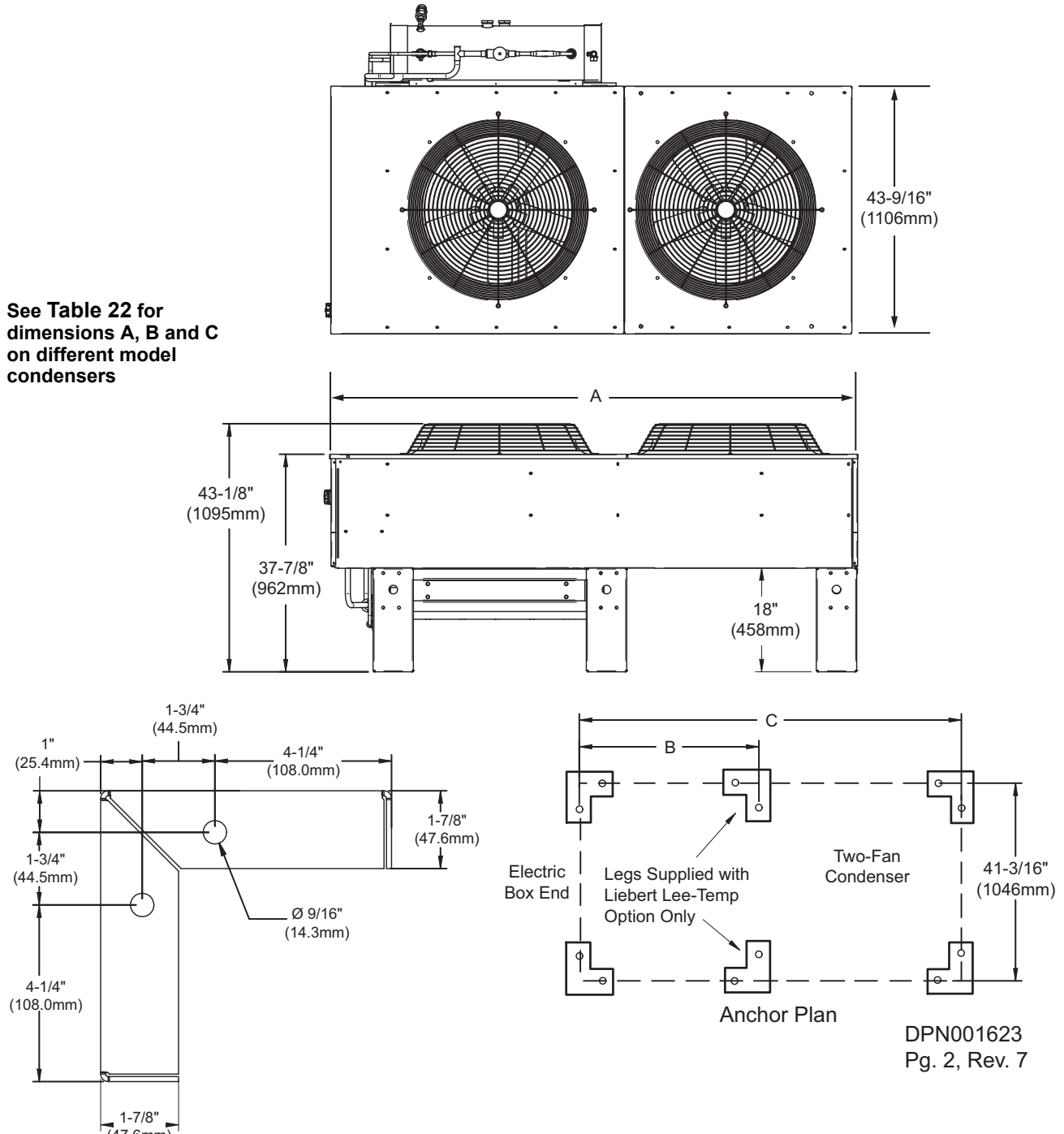
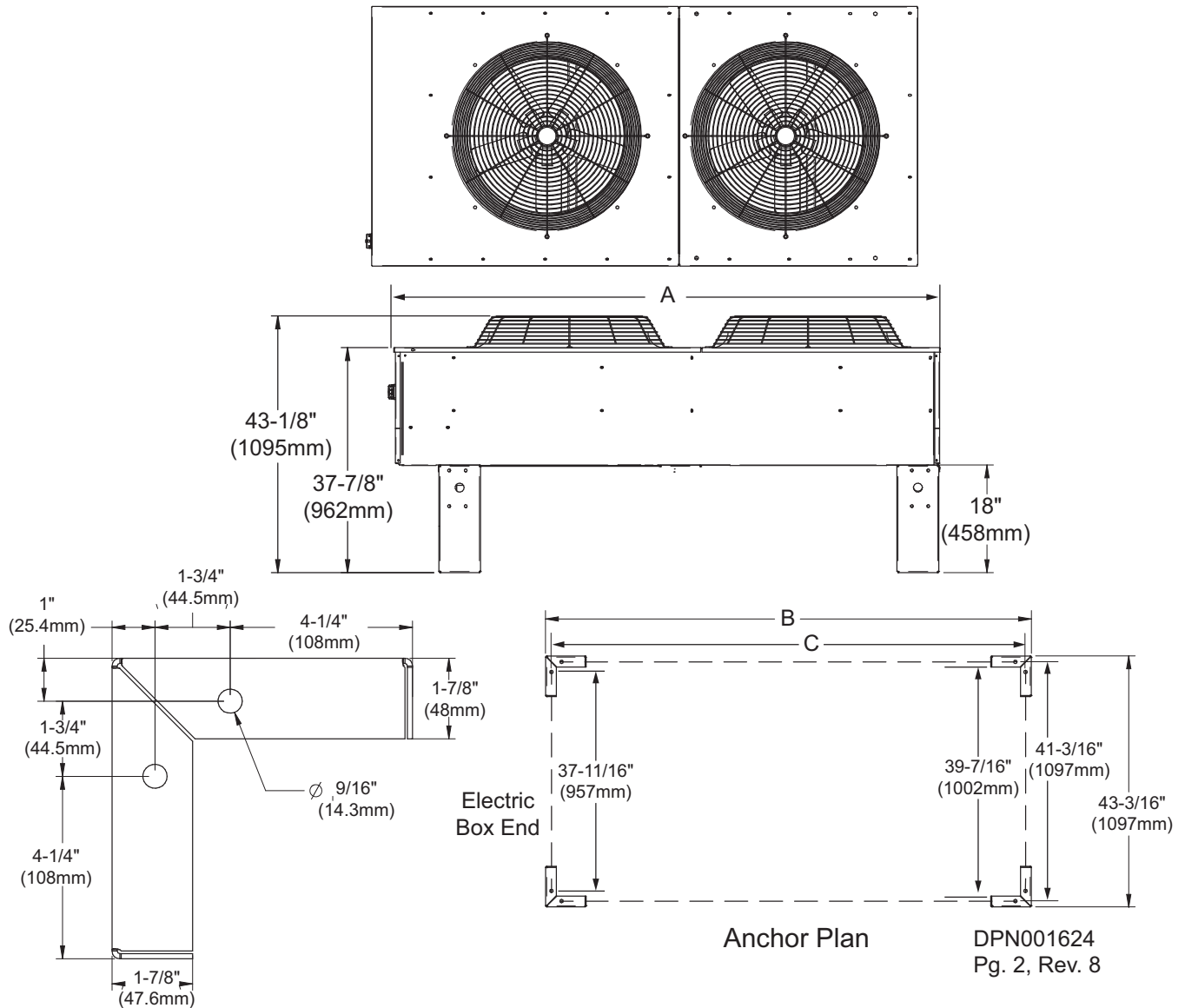


Table 22 Cabinet and anchor dimensions, R-410A, Liebert Lee-Temp control single circuit condensers, 60Hz

Model No.	# of Fans	# of Legs	A in. (mm)	B in. (mm)	C in. (mm)	Net Weight lb. (kg)
DCSL28K	1	4	51-1/2 (1308)	42 (1067)	—	325 (147)
DCSL60K	2	6	91-1/2 (2324)	42 (1067)	82 (2083)	475 (215)
DCSL90K	3	6	131-1/2 (3340)	42 (1067)	124 (3150)	675 (306)

Source DPN001623, Rev. 7, Pg. 2

Figure 33 Cabinet and anchor dimensions, R-410A VFD control fin/tube condensers

Model No.	# of Fans	A	B	C	Net Weight
		In. (mm)	In. (mm)	In. (mm)	lb. (kg)
TCSV28K	1	51-1/2 (1308)	44 (1118)	42 (1067)	325 (148)
TCSV60K	2	91-1/2 (2324)	84 (2134)	82 (2083)	470 (213)
TCSV90K	3	131-1/2 (3340)	124 (3150)	122 (3099)	670 (304)

Source: DPN001624, Rev. 8

4.9 Electrical Field Connections Fin/Tube

Table 23 Electrical data—60Hz fin/tube condenser

Model #		28K			60K			90K		
# of Fans		1			2			3		
Input Voltage	ph	FLA	WSA	OPD	FLA	WSA	OPD	FLA	WSA	OPD
VFD Controlled										
208/230	3	3.7	4.6	15	7.2	8.1	15	10.7	11.6	15
460		1.8	2.3	15	3.5	4.0	15	5.2	5.7	15
Liebert Lee-Temp™ Controlled/Fan-Cycling										
208/230	3	3.5	4.4	15	7.0	7.9	15	10.5	11.4	15
460		1.7	2.1	15	3.4	3.8	15	5.1	5.5	15
575		1.4	1.8	15	2.8	3.2	15	4.2	4.6	15

FLA = Full Load Amps; WSA = Wire Size Amps; OPD = Maximum Overcurrent Protection Device

Figure 34 Electrical field connections, R410A VFD fin/tube condensers

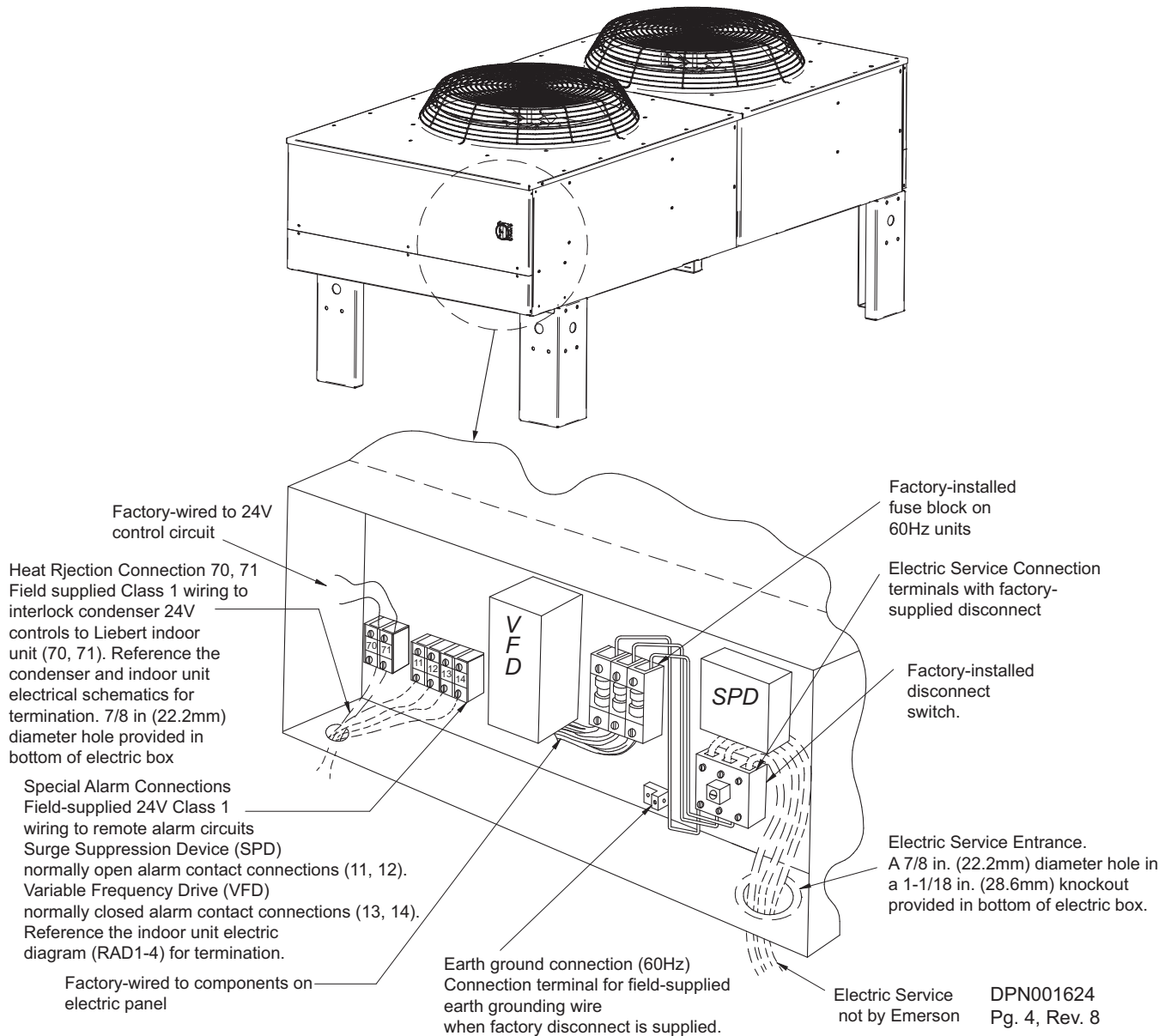
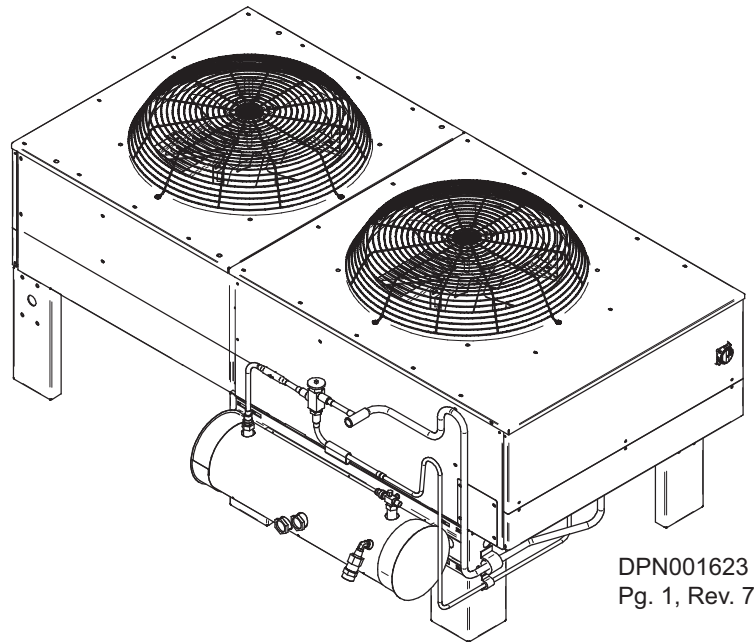


Figure 35 Liebert air-cooled R-410A fin/tube condensers with Liebert Lee-Temp™

4.9.1 Features—Liebert Air Cooled R-410A Fin/Tube Condensers with Liebert Lee-Temp

Source DPN001623, Pg. 1, Rev. 7

Coil—Coil is constructed of copper tubes in a staggered tube pattern. Tubes are expanded into continuous, rippled or enhanced aluminum type fins. The fins have full depth fin collars completely covering the copper tubes, which are connected to heavy wall type L headers. Inlet coil connector tubes pass through relieved holes in the tube sheet for maximum resistance to piping strain and vibration. Coils are factory leak tested at a minimum of 475 PSIG, dehydrated, then filled and sealed with an inert gas holding charge for shipment.

Fan(s)—Blades are constructed of aluminum, with a diameter of 26 inches (660.4mm) and secured to the fan shaft by a heavy duty painted steel hub with set screw. Fan guards are heavy gauge, close meshed, steel wire with corrosion resistant finish. Fans are factory balanced and tested before shipment.

Fan Motor(s)—Provided with rain slingers, permanently lubricated bearings, and individual built-in overload protection. Motors are rigidly mounted on die-formed galvanized steel supports.

Head Pressure Control—A Liebert Lee-Temp control system is furnished for each circuit and consists of an insulated, heated receiver tank with sight glasses, pressure relief valve, roto lock valve, and head pressure operated three-way valve for field-connection to air cooled condenser. This system allows operation at ambient conditions as low as -30°F (-34°C).

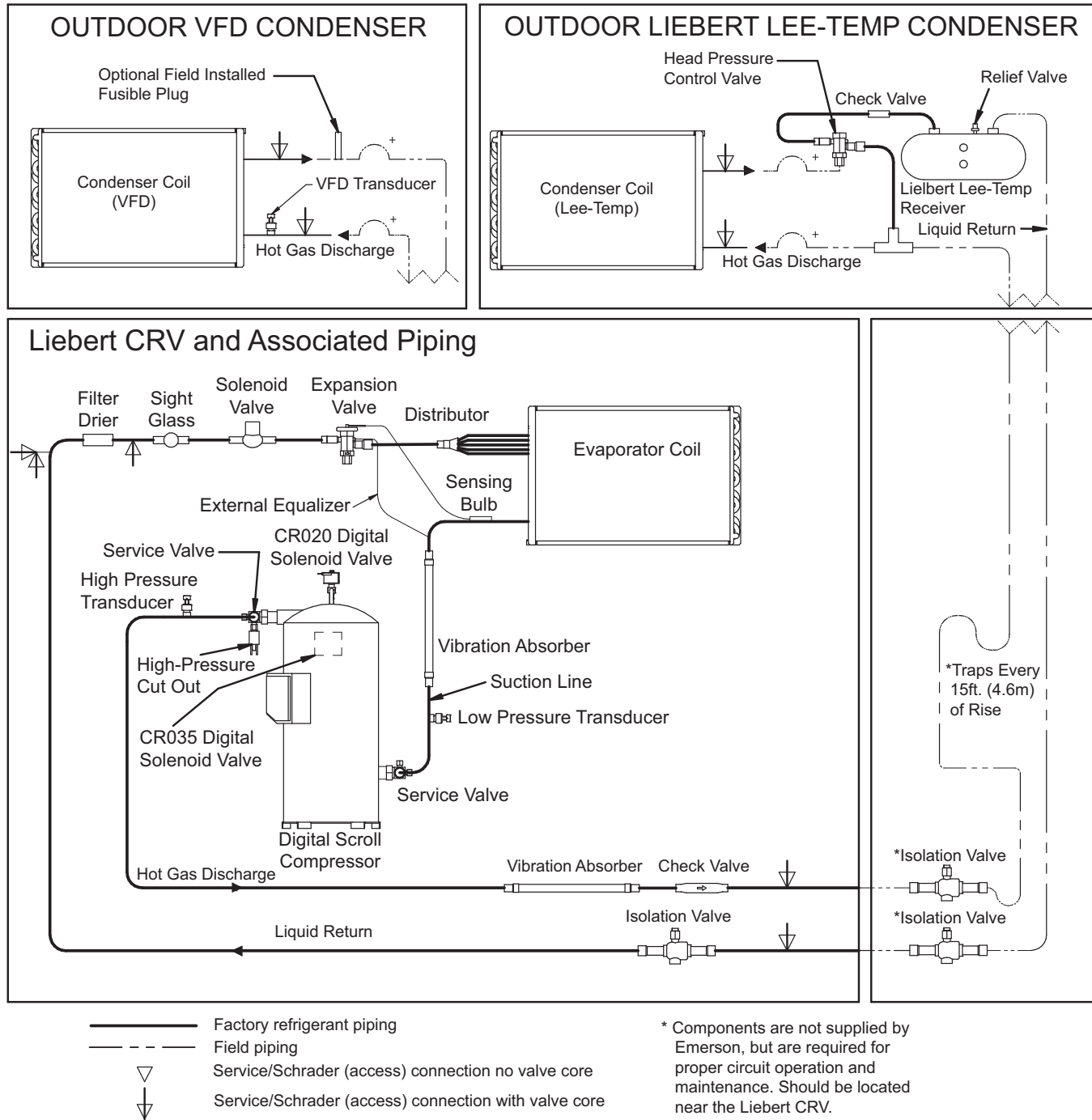
Housing—The condenser housing is constructed of bright aluminum sheet and divided into individual fan sections by full width baffles. Structural support members, including coil support frame, motor, and drive support, are galvanized steel for strength and corrosion resistance. Aluminum legs are provided with rigging holes For Hoisting The Unit Into Position.

Unit Disconnect Switch—A locking disconnect factory-installed and wired in enclosed condenser control section.

Electrical Controls—Electrical controls, overload protection devices and service connection terminals are provided and factory-wired inside the integral NEMA 3R electrical panel section of the housing. Only supply wiring and indoor unit interlock wiring are required at condenser installation.

4.10 Piping—Liebert Fin/Tube Condensers

Figure 36 General arrangement diagram fin/tube condensers—600mm (24 in.) air-cooled models with and without Liebert Lee-Temp™



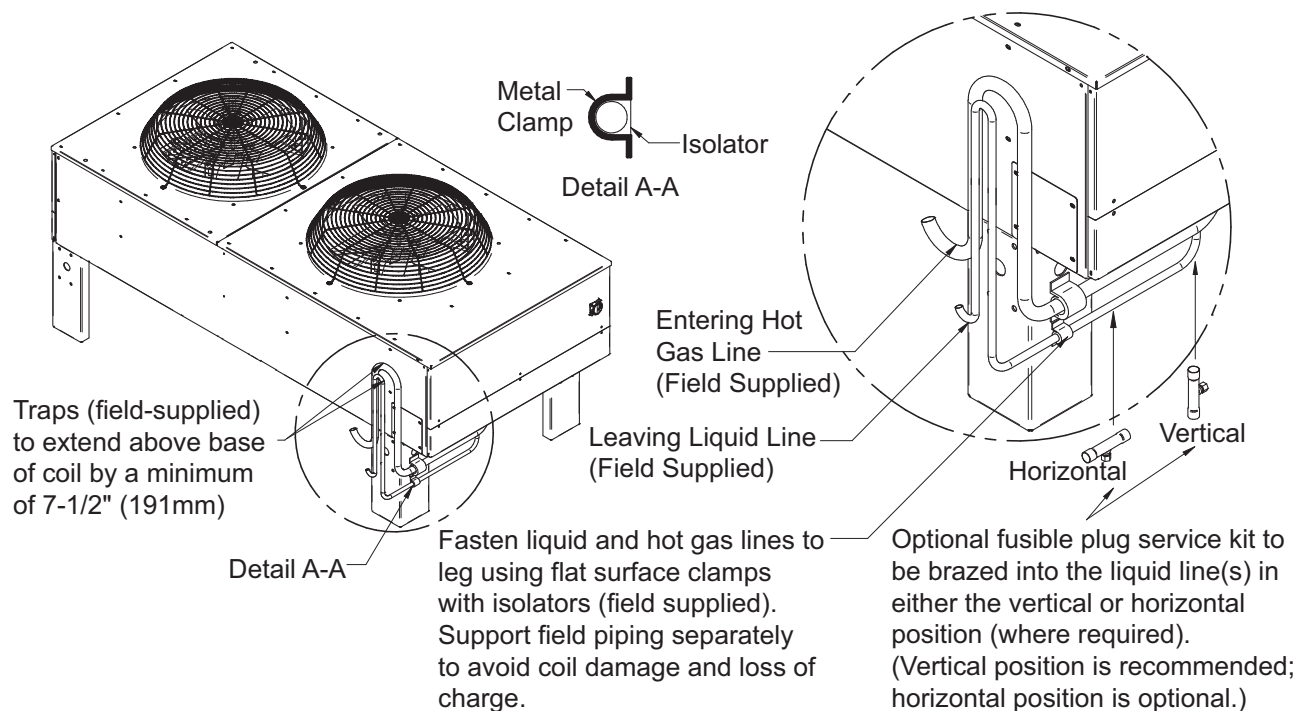
NOTES:

1. Schematic representation shown. Do not use for specific connection locations.
2. One or more additional pressure relief valves are required downstream of any and all field-installed isolation. Do not isolate any refrigerant circuits from overpressurization protection.

* Components are not supplied by Emerson, but are required for proper circuit operation and maintenance. Should be located near the Liebert CRV.

+ Inverted trap discharge and liquid lines to extend above the base of the coil a minimum of 7-1/2" (190mm).

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Figure 37 Piping R-410A VFD control single circuit fin/tube condensers

DPN001624

Pg. 3, Rev. 8

Table 24 Piping and refrigerant sizes for Liebert air-cooled, VFD control fin/tube single-circuit condensers with R-410A

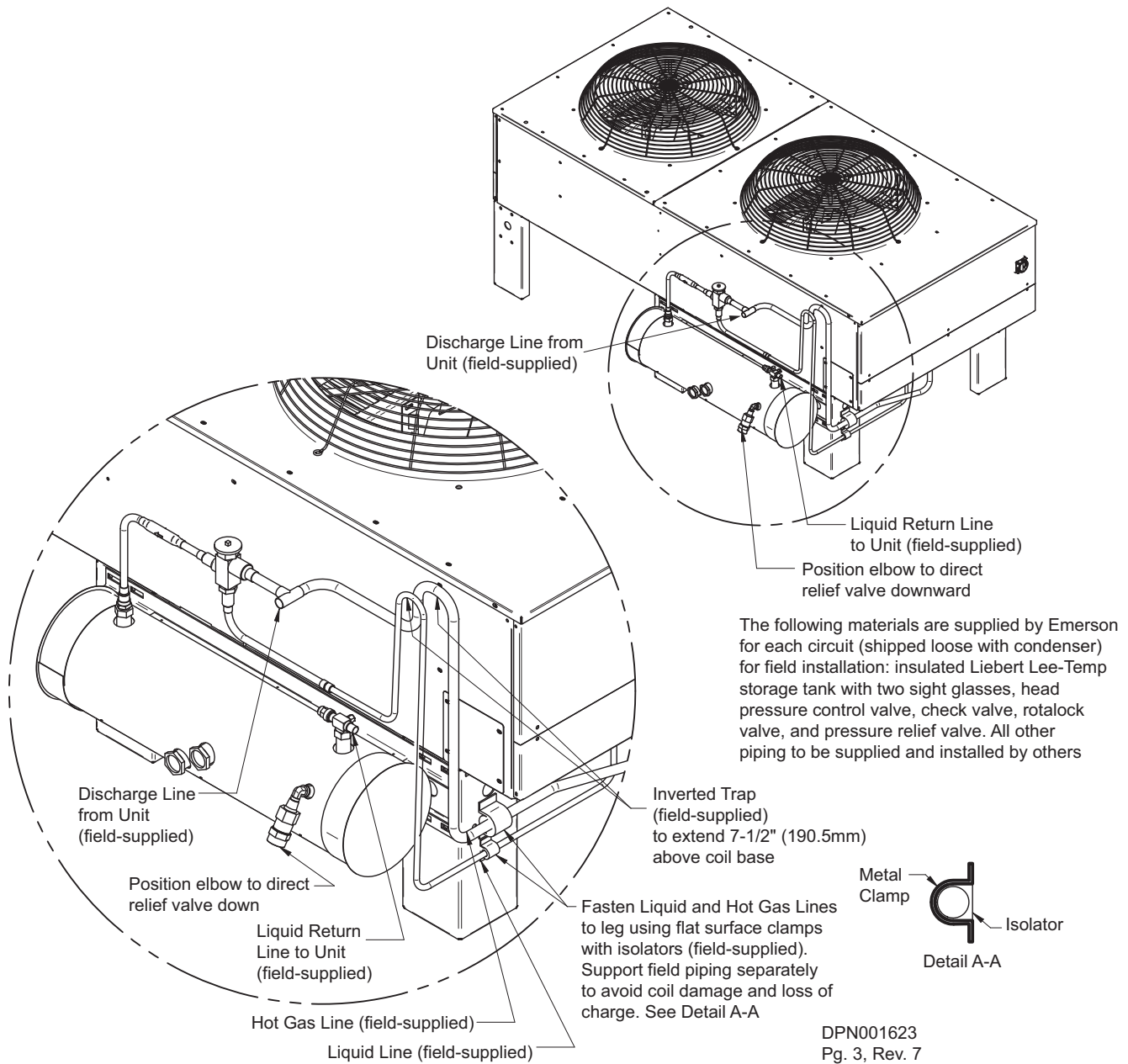
Condenser Piping Connection Sizes, Cu, O.D.			Weight, lb. (kg)
Condenser Model #	Entering Hot Gas Line, in. (mm)	Returning Liquid Line, in. (mm)	
TCSV28K	1-1/8 (28.6)	7/8 (22.2)	325 (148)
TCSV60K	1-1/8 (28.6)	7/8 (22.2)	470 (213)
TCSV90K	1-1/8 (28.6)	7/8 (22.2)	670 (304)

Interconnection piping (field-supplied and installed) required. Configure piping for parallel refrigerant flow between condenser sections.
Source DPN001624, Rev. 8, Pp. 2 and 3

Table 25 Recommended refrigerant line sizes for Liebert air-cooled, VFD control fin/tube condensers with R-410A, with and without Liebert Lee-Temp™, Cu, OD

Model #	Total Equivalent Length, ft. (m)	Hot Gas Line, in. (m)	Liquid Line, in. (m)
CR020RA	50 (15.2)	3/4 (19.1)	5/8 (15.9)
	100 (30.5)	3/4 (19.1)	5/8 (15.9)
	150 (45.7)	3/4 (19.1)	5/8 (15.9)
	300 (91.4)	7/8 (22.2) ²	3/4 (19.1)
CR035RA	50 (15.2)	7/8 (22.2)	3/4 (19.1)
	100 (30.5)	7/8 (22.2)	3/4 (19.1)
	150 (45.7)	7/8 (22.2)	3/4 (19.1)
	300 (91.4)	1-1/8 (28.6) ²	7/8 (22.2)

1. Consult factory for proper line sizing for runs longer than 300 ft. (91.4m) equivalent length.
2. Must downsize vertical riser one trade size (1-1/8" to 7/8" or 7/8" to 3/4").
3. Source DPN001624, Rev. 8, Pg. 3

Figure 38 Fin/tube condenser piping, R-410A single-circuit with Liebert Lee-Temp™**Table 26** Piping and refrigerant sizes for Liebert Lee-Temp condensers with R-410A

Condenser Piping Connection Sizes						
Condenser Connections, O.D., in.			Liebert Lee-Temp Size, in. (mm)	Liebert Lee-Temp Connections, I.D., in.		
Condenser Model #	Hot Gas	Liquid		Hot Gas Tee	Liquid to L-T Valve	Receiver Out
DCSL28K	1-1/8	7/8	9 x 36 (229 x 914)	1-1/8	5/8	7/8
DCSL60K	1-1/8	7/8	11 x 36 (279 x 914)	1-1/8	5/8	7/8
DCSL90K	1-1/8	7/8	11 x 48 (279 x 1219)	1-1/8	5/8	7/8

Source DPN001623, Rev. 7, Pg. 3

4.11 Liebert Air-Cooled R-410A VFD Control Fin/Tube Condensers Features

4.11.1 Features—Liebert Air-Cooled R-410A VFD Control Fin/Tube Condensers

Source: DPN001624, Pg. 1, Rev. 8

Coil—The coil is constructed of copper tubes in a staggered tube pattern. Tubes are expanded into continuous, rippled or enhanced aluminum type fins. The fins have full depth fin collars completely covering the copper tubes which are connected to heavy wall type L headers. Inlet coil connector tubes pass through relieved holes in the tube sheet for maximum resistance to piping strain and vibration. Coils are factory leak tested at a minimum of 475 PSIG, dehydrated, then filled and sealed with an inert gas holding charge for shipment.

Fans—Blades are constructed of zinc-plated steel or aluminum with a diameter of 26" (660mm) and secured to the fan shaft by a heavy duty hub with set screw. Fan guards are heavy gauge, close-meshed steel wire with corrosion resistant finish. Fans are factory-balanced and factory-tested before shipment.

Fan Motors—The variable speed fan motor is a specifically designed inverter duty motor with permanently lubricated ceramic bearings. The Liebert variable frequency drive (VFD) control system provides overload protection for the variable speed motor. Each ambient-temperature-controlled fan motor has built-in overload protection. All motors have rain slingers, permanently lubricated bearings and are rigidly mounted on die-formed galvanized steel supports.

Head Pressure Control—The Liebert VFD condenser control system is complete with variable frequency drive (VFD), inverter duty fan motor operating from 0% to 100% motor RPM based on head pressure, refrigerant pressure transducers, ambient-temperature thermostat(s), motor overload protection and electrical control circuit factory-wired in the control panel. VFD control is always furnished on the fan adjacent to the connection end of the condenser, which runs continuously with the compressors. Other condenser fans are controlled by ambient thermostats and are either On or Off. This system allows for operation at ambient conditions as low as -20°F (-28.9°C).

Housing—The condenser housing is constructed of bright aluminum sheet and divided into individual fan sections by full width baffles. Structural support members, including coil support frame, motor and drive support, are galvanized steel for strength and corrosion resistance. Aluminum legs are provided with rigging holes for hoisting the unit into position.

SPD and Unit Disconnect Switch—Surge protective device and locking disconnect factory-installed and wired in enclosed condenser control section.

Alarm Contacts—Normally open dry contacts provided for indication of VFD and SPD alarm condition.

4.11.2 Optional Features—Liebert Air-Cooled R-410A VFD Control Fin/Tube Condensers

Source DPN001624, Pg. 1, Rev. 8

Fusible Plug Service Kit—Provides compliance for local codes requiring fusible-plug-type pressure relief devices. Shipped loose for field-installation on each liquid line.

5.0 LIEBERT CRV WATER/GLYCOL SYSTEMS

5.1 CAPACITY AND PHYSICAL DATA—600MM (24IN.) MODELS

Table 27 Performance data—Water-cooled, 600mm (24in.) Model CR020RW

Return Air Temperature	83°F (28.33°C) EWT - 95°F (35°C) LWT	85°F (29.4°C) EWT - 110°F (43.3°C) Cond. Temp.
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB) 17% RH		
Total, kBTU/H (kW)	28.0 (95.7)	27.6 (94.1)
Sensible, kBTU/H (kW)	28.0 (95.7)	27.6 (94.1)
Flow Rate, GPM (l/s)	19.0 (1.2)	14.2 (0.9)
Pressure Drop, ft water (kPa)	45.9 (137.1)	26.3 (78.5)
Heat Rejection, kBTU/H (kW)	113.6 (33.3)	113 (33.1)
100°F DB, 69.5°F WB (37.8°C DB, 20.8°C WB) 20% RH		
Total, kBTU/H (kW)	91.5 (26.8)	90.0 (26.4)
Sensible, kBTU/H (kW)	91.5 (26.8)	90.0 (26.4)
Flow Rate, GPM (l/s)	18.2 (1.15)	13.6 (0.85)
Pressure Drop, ft water (kPa)	42.5 (126.9)	24 (71.9)
Heat Rejection, kBTU/H (kW)	109.3 (26.8)	108.8 (31.9)
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB) 23% RH		
Total, kBTU/H (kW)	87.6 (25.7)	86.0 (25.2)
Sensible, kBTU/H (kW)	87.2 (25.6)	85.9 (25.2)
Flow Rate, GPM (l/s)	17.6 (1.11)	12.9 (0.81)
Pressure Drop, ft water (kPa)	39.7 (118.7)	21.9 (65.5)
Heat Rejection, kBTU/H (kW)	105.2 (25.7)	104.6 (30.6)
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB) 27% RH		
Total, kBTU/H (kW)	84.7 (24.8)	82.8 (24.3)
Sensible, kBTU/H (kW)	81.5 (23.9)	80.5 (23.6)
Flow Rate, GPM (l/s)	17.1 (1.08)	12.3 (0.77)
Pressure Drop, ft water (kPa)	37.6 (112.4)	20.0 (59.7)
Heat Rejection, kBTU/H (kW)	102.2 (24.8)	101.3 (29.7)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB) 31% RH		
Total, kBTU/H (kW)	82.2 (24.1)	80.3 (23.5)
Sensible, kBTU/H (kW)	75.1 (22.0)	74.2 (21.8)
Flow Rate, GPM (l/s)	16.6 (1.05)	11.8 (0.74)
Pressure Drop, ft water (kPa)	35.5 (106.2)	18.5 (55.3)
Heat Rejection, kBTU/H (kW)	99.6 (24.1)	98.7 (28.9)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH		
Total, kBTU/H (kW)	79.8 (23.4)	78.0 (22.9)
Sensible, kBTU/H (kW)	68.6 (20.1)	67.7 (19.8)
Flow Rate, GPM (l/s)	16.2 (1.03)	11.7 (0.74)
Pressure Drop, ft water (kPa)	34.0 (101.7)	18.2 (54.4)
Heat Rejection, kBTU/H (kW)	97.1 (23.4)	96.3 (28.2)
80°F DB, 66.5°F WB (26.7°C DB, 19.2°C WB) 50% RH		
Total, kBTU/H (kW)	85.1 (24.9)	83.1 (24.4)
Sensible, kBTU/H (kW)	60.5 (17.7)	59.7 (17.5)
Flow Rate, GPM (l/s)	17.1 (1.08)	12.5 (0.79)
Pressure Drop, ft water (kPa)	37.6 (112.4)	20.6 (61.5)
Heat Rejection, kBTU/H (kW)	102.9 (30.1)	101.6 (29.8)

1. The net capacity data has fan motor heat factored in for all ratings.
2. Capacity data is factory-certified to be within 5% tolerance.
3. Data rated with standard filter.

Table 28 Performance data—Water-cooled, 600mm (24in.) Model CR035RW

Return Air Temperature	83°F (28.33°C) EWT - 95°F (35°C) LWT	85°F (29.4°C) EWT - 110°F(43.3°C) Cond. Temp.
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB) 17% RH		
Total, kBTU/H (kW)	152.3 (44.6)	150.3 (44.0)
Sensible, kBTU/H (kW)	152.3 (44.6)	150.3 (44)
Flow Rate, GPM (l/s)	30.1 (1.9)	23.5 (1.48)
Pressure Drop, ft water (kPa)	66.8 (199.6)	41.2 (123.2)
Heat Rejection, kBTU/H (kW)	180.2 (52.8)	179.6 (52.6)
100°F DB, 69.5°F WB (37.8°C DB, 20.8°C WB) 20% RH		
Total, kBTU/H (kW)	147.2 (43.1)	144.7 (42.4)
Sensible, kBTU/H (kW)	144.5 (42.3)	143.1 (41.9)
Flow Rate, GPM (l/s)	29.2 (1.85)	22.5 (1.42)
Pressure Drop, ft water (kPa)	63.1 (188.5)	37.8 (113)
Heat Rejection, kBTU/H (kW)	175.0 (51.3)	174.1 (51)
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB) 23% RH		
Total, kBTU/H (kW)	142.9 (41.9)	140.2 (41.1)
Sensible, kBTU/H (kW)	135.6 (39.8)	134.4 (39.4)
Flow Rate, GPM (l/s)	29.8 (1.8)	21.5 (1.35)
Pressure Drop, ft water (kPa)	60.0 (179.2)	34.6 (103.3)
Heat Rejection, kBTU/H (kW)	170.7 (50)	169.5 (49.7)
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB) 27% RH		
Total, kBTU/H (kW)	138.7 (40.7)	135.9 (39.8)
Sensible, kBTU/H (kW)	126.6 (37.1)	125.3 (36.7)
Flow Rate, GPM (l/s)	27.8 (1.75)	20.3 (1.28)
Pressure Drop, ft water (kPa)	56.9 (170.2)	31.1 (92.9)
Heat Rejection, kBTU/H (kW)	166.5 (48.8)	165.3 (48.4)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB) 31% RH		
Total, kBTU/H (kW)	134.8 (39.5)	132.1 (38.7)
Sensible, kBTU/H (kW)	117.3 (34.4)	116.1 (34)
Flow Rate, GPM (l/s)	27.1 (1.71)	20.3 (1.28)
Pressure Drop, ft water (kPa)	54.5 (162.9)	31.0 (92.8)
Heat Rejection, kBTU/H (kW)	162.5 (47.6)	161.5 (47.3)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH		
Total, kBTU/H (kW)	130.9 (38.4)	128.4 (37.6)
Sensible, kBTU/H (kW)	107.7 (31.6)	106.5 (31.2)
Flow Rate, GPM (l/s)	26.0 (1.64)	19.8 (1.25)
Pressure Drop, ft water (kPa)	50.2 (150)	29.5 (88.3)
Heat Rejection, kBTU/H (kW)	158.6 (46.5)	157.6 (46.2)
80°F DB, 66.5°F WB (26.7°C DB, 19.2°C WB) 50% RH		
Total, kBTU/H (kW)	139.5 (40.9)	136.8 (40.1)
Sensible, kBTU/H (kW)	95.8 (28.1)	94.6 (27.7)
Flow Rate, GPM (l/s)	28.0 (1.77)	21.2 (1.34)
Pressure Drop, ft water (kPa)	57.9 (173.2)	33.7 (100.8)
Heat Rejection, kBTU/H (kW)	167.3 (49.0)	166.1 (48.7)

1. The net capacity data has fan motor heat factored in for all ratings.
2. Capacity data is factory-certified to be within 5% tolerance.
3. Data rated with standard filter.

Table 29 Performance data—GLYCOL-cooled, 600mm (24in.) models CR035RW and CR020RW

Return Air Temperature	Glycol (40% Propylene) 104°F (40°C) EWT - 115°F (46.1°C) LWT	
	CR035RW	CR020RW
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB) 17% RH		
Total, kBTU/H (kW)	141.4 (41.5)	88.3 (25.9)
Sensible, kBTU/H (kW)	141.4 (41.5)	88.3 (25.9)
Flow Rate, GPM (l/s)	34.4 (2.17)	21.8 (1.37)
Pressure Drop, ft. water (kPa)	98.2 (293.6)	67.6 (202.2)
Heat Rejection, kBTU/H (kW)	177.3 (52.0)	111.0 (32.6)
100°F DB, 69.5°F WB (37.8°C DB, 20.8°C WB) 20% RH		
Total, kBTU/H (kW)	135.5 (39.7)	84.4 (24.7)
Sensible, kBTU/H (kW)	135.5 (39.7)	84.4 (24.7)
Flow Rate, GPM (l/s)	33.5 (2.11)	21.0 (1.32)
Pressure Drop, ft. water (kPa)	93.4 (279.2)	63.2 (189.0)
Heat Rejection, kBTU/H (kW)	171.2 (50.2)	107.0 (31.4)
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB) 23% RH		
Total, kBTU/H (kW)	129.9 (38.0)	80.5 (23.6)
Sensible, kBTU/H (kW)	128.9 (37.7)	80.5 (23.6)
Flow Rate, GPM (l/s)	32.4 (2.04)	20.1 (1.27)
Pressure Drop, ft. water (kPa)	87.4 (261.3)	58.3 (174.2)
Heat Rejection, kBTU/H (kW)	165.5 (48.5)	102.9 (30.2)
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB) 27% RH		
Total, kBTU/H (kW)	125.7 (36.8)	76.6 (22.5)
Sensible, kBTU/H (kW)	120.5 (35.3)	76.6 (22.5)
Flow Rate, GPM (l/s)	32.0 (2.02)	19.4 (1.22)
Pressure Drop, ft. water (kPa)	85.4 (255.4)	54.2 (161.9)
Heat Rejection, kBTU/H (kW)	161.1 (47.2)	98.9 (29)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB) 31% RH		
Total, kBTU/H (kW)	121.8 (35.7)	73.9 (21.6)
Sensible, kBTU/H (kW)	111.3 (32.6)	71.2 (20.9)
Flow Rate, GPM (l/s)	31.0 (1.96)	18.9 (1.19)
Pressure Drop, ft. water (kPa)	80.3 (240.1)	51.5 (154)
Heat Rejection, kBTU/H (kW)	157.4 (46.1)	95.9 (28.1)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH		
Total, kBTU/H (kW)	118.2 (34.7)	71.6 (21.0)
Sensible, kBTU/H (kW)	101.8 (29.8)	65.6 (19.2)
Flow Rate, GPM (l/s)	30.1 (1.9)	13.1 (0.8)
Pressure Drop, ft. water (kPa)	76.0 (227.1)	25.9 (77.4)
Heat Rejection, kBTU/H (kW)	153.7 (45.1)	93.3 (27.3)
80°F DB, 66.5°F WB (26.7°C DB, 19.2°C WB) 50% RH		
Total, kBTU/H (kW)	126.0 (36.9)	76.3 (22.4)
Sensible, kBTU/H (kW)	90.0 (26.4)	56.8 (16.6)
Flow Rate, GPM (l/s)	31.6 (2.0)	19.4 (1.2)
Pressure Drop, ft. water (kPa)	83.5 (249.6)	54.2 (161.9)
Heat Rejection, kBTU/H (kW)	161.6 (47.4)	98.5 (28.9)

1. The net capacity data has fan motor heat factored in for all ratings.
2. Capacity data is factory-certified to be within 5% tolerance.
3. Data rated with standard filter.

Table 30 Performance data—Water-cooled, 300mm (12 inch) units CR019RW

Return Air Temperature	83°F (28.33°C) EWT 95°F (35°C) LWT	85°F (29.4°C) EWT
105°F DB, 70.5°F WB (40.6°C DB, 21.4 °C WB) 17% RH		
Total, kBTU/H (kW)	90.2 (26.4)	89.7 (26.3)
Sensible, kBTU/H (kW)	90.2 (26.4)	89.7 (26.3)
Flow Rate, GPM (l/s)	18.0 (1.1)	18.0 (1.1)
Pressure Drop, ft water (kPa)	41.2 (123.2)	41.2 (123.2)
Heat Rejection, kBTU/H (kW)	109.6 (28.3)	109.4 (32.1)
100°F DB, 69.1°F WB (37.8°C DB, 20.6°C WB) 20% RH		
Total, kBTU/H (kW)	86.4 (25.3)	85.8 (25.2)
Sensible, kBTU/H (kW)	86.4 (25.3)	85.8 (25.2)
Flow Rate, GPM (l/s)	17.6 (1.1)	17.6 (1.1)
Pressure Drop, ft water (kPa)	39.7 (118.7)	39.5 (118.7)
Heat Rejection, kBTU/H (kW)	105.6 (30.9)	105.4 (30.9)
95°F DB, 67.4°F WB (35°C DB, 19.7°C WB) 23% RH		
Total, kBTU/H (kW)	83.2 (24.4)	82.5 (24.2)
Sensible, kBTU/H (kW)	81.8 (24.0)	81.4 (23.9)
Flow Rate, GPM (l/s)	17.1 (1.1)	17.1 (1.1)
Pressure Drop, ft water (kPa)	37.4 (111.7)	37.4 (111.7)
Heat Rejection, kBTU/H (kW)	102.2 (30)	101.9 (29.9)
90°F DB, 65.9°F WB (32.2°C DB, 18.8°C WB) 27% RH		
Total, kBTU/H (kW)	80.8 (23.7)	80 (23.5)
Sensible, kBTU/H (kW)	76 (22.3)	75.7 (22.2)
Flow Rate, GPM (l/s)	16.6 (1.05)	16.6 (1.05)
Pressure Drop, ft water (kPa)	35.3 (105.6)	35.3 (105.6)
Heat Rejection, kBTU/H (kW)	99.7 (29.2)	99.4 (29.1)
85°F DB, 64.5°F WB (29.4°C DB, 18.05°C WB) 31% RH		
Total, kBTU/H (kW)	78.1 (22.9)	77.4 (22.7)
Sensible, kBTU/H (kW)	70.5 (20.7)	70.2 (20.6)
Flow Rate, GPM (l/s)	16.2 (1.03)	16.2 (1.03)
Pressure Drop, ft water (kPa)	33.7 (100.8)	33.7 (100.8)
Heat Rejection, kBTU/H (kW)	97 (28.4)	96.7 (28.3)
80°F DB, 62.5°F WB (26.6°C DB, 16.94°C WB) 37% RH		
Total, kBTU/H (kW)	76.1 (22.3)	75.4 (22.1)
Sensible, kBTU/H (kW)	64.1 (18.8)	63.8 (18.7)
Flow Rate, GPM (l/s)	15.9 (1.0)	15.9 (1.0)
Pressure Drop, ft water (kPa)	32.5 (97.3)	32.5 (97.3)
Heat Rejection, kBTU/H (kW)	94.8 (27.8)	94.6 (27.7)
80°F DB, 66.6°F WB (26.6°C DB, 19.2°C WB) 50% RH		
Total, kBTU/H (kW)	81.8 (24)	81.1 (23.8)
Sensible, kBTU/H (kW)	55.5 (16.3)	55.2 (16.2)
Flow Rate, GPM (l/s)	16.9 (1.07)	16.9 (1.07)
Pressure Drop, ft water (kPa)	36.5 (109.2)	36.5 (109.2)
Heat Rejection, kBTU/H (kW)	100.8 (29.5)	100.4 (29.4)

1. The net capacity data has fan motor heat factored in for all ratings.
2. Capacity data is factory-certified to be within 5% tolerance.

Table 31 Physical data—600mm (24in.) water/glycol-cooled systems

	CR020RW	CR035RW
Fan Data	2454 (4170)	3260 (5540)
Total Airflow, CFM (m³/h)	2454 (4170)	3260 (5540)
Total Fan Motor, hp (kW)	0.8 (0.6)	1.4 (1.06)
Number of Fans	2	
Evaporator Coil		
Face Area, ft² (m²)	7.26 (0.674)	
Rows	4	5
Face Velocity, FPM (m/s)	339 (1.72)	449 (2.28)
Electric Reheat Single Stage		
Capacity, BTU/H (kW)	460V: 20,472 (6.0) 208V: 16,719 (4.9)	
Steam Generating Humidifier		
Capacity, lb/hr (kg/hr)	5 (2.3)	
Capacity, kW	1.79	
Condensate Pump - Dual Float Type		
Capacity, GPM (l/m)	6 (22.7)	
Filter Section - Disposable Type		
	MERV 8 - Standard Pleated Filter	
Number	2	
Nominal Size, in (mm)	31-1/2 x 17-1/2 x 4 (800 x 445 x 100)	
Effective Surface Area - ft² (m²)	16.4 (1.52)	
	MERV 11 - Optional Pleated Filter	
Quantity	2	
Nominal Size, in (mm)	31-1/2 x 17-1/2 x 4 (800 x 445 x 100)	
Effective Surface Area - ft² (m²)	16.4 (1.52)	

Table 32 Physical data—Water/glycol-cooled, 300mm (12in.) wide models

System	19kW Model
Fan Data	
Total Airflow, CFM (m ³ /h)	2250 (3823)
Total Fan Motor, hp (kW)	0.65 (0.48)
Number of Fans	5
Evaporator Coil	
Face Area, ft ² (m ²)	6.46 (0.60)
Rows	3
Face Velocity, FPM (m/s)	348 (1.77)
Condensate Pump - Dual Float Type	
Capacity, GPM (l/m)	208V condensate pump rated for 0.77GPM at 13 ft. (2.8 l/m at 3.9m) of total head pressure at 13 ft. (3.4 l/m at 3.9m) of total head pressure 266V condensate pump rated for 0.81 GPM at 13 ft. (3.1 l/m at 3.9 m) of total head pressure
Filter Section—MERV 1, Washable Type	
Quantity	2
Nominal Size, in (mm)	35.5 x 10.6 x 0.4 (902 x 269 x 10)
Effective Surface Area, ft ² (m ²)	2.3 (0.21)

Table 33 Performance data—Glycol-cooled, 300mm (12 inch) units

Return Air Temperature	Glycol (40% Propylene) 104°F (40°C) EWT; 115°F (46.1°C) LWT
105°F DB, 70.9°F WB (40.6°C DB, 21.6°C WB) 17% RH	
Total, kBTU/H (kW)	83.3 (24.4)
Sensible, kBTU/H (kW)	83.3 (24.4)
Flow Rate, GPM (l/s)	21.0 (1.32)
Pressure Drop, ft water (kPa)	63.2 (189.0)
Heat Rejection, kBTU/H (kW)	107.5 (31.5)
100°F DB, 69.1°F WB (37.8°C DB, 20.6°C WB) 20% RH	
Total, kBTU/H (kW)	83.3 (24.4)
Sensible, kBTU/H (kW)	83.3 (24.4)
Flow Rate, GPM (l/s)	21.1 (1.33)
Pressure Drop, ft water (kPa)	64.0 (191.2)
Heat Rejection, kBTU/H (kW)	107.5 (31.5)
95°F DB, 67.4°F WB (35°C DB, 19.6°C WB) 23% RH	
Total, kBTU/H (kW)	76.0 (22.3)
Sensible, kBTU/H (kW)	76.0 (22.3)
Flow Rate, GPM (l/s)	19.6 (1.24)
Pressure Drop, ft water (kPa)	55.5 (165.9)
Heat Rejection, kBTU/H (kW)	99.8 (29.3)
90°F DB, 66.9°F WB (32.2°C DB, 19.3°C WB) 27% RH	
Total, kBTU/H (kW)	72.7 (21.3)
Sensible, kBTU/H (kW)	71.9 (21.1)
Flow Rate, GPM (l/s)	19.0 (1.2)
Pressure Drop, ft water (kPa)	52.2 (156.0)
Heat Rejection, kBTU/H (kW)	96.4 (28.2)
85°F DB, 64°F WB (29.4°C DB, 17.7°C WB) 31% RH	
Total, kBTU/H (kW)	70.1 (20.5)
Sensible, kBTU/H (kW)	66.7 (19.6)
Flow Rate, GPM (l/s)	18.4 (1.16)
Pressure Drop, ft water (kPa)	48.9 (146.3)
Heat Rejection, kBTU/H (kW)	93.6 (27.4)
80°F DB, 62.5°F WB (26.6°C DB, 16.94°C WB) 37% RH	
Total, kBTU/H (kW)	68.2 (20.0)
Sensible, kBTU/H (kW)	60.4 (17.7)
Flow Rate, GPM (l/s)	18.0 (1.14)
Pressure Drop, ft water (kPa)	47.1 (140.6)
Heat Rejection, kBTU/H (kW)	91.6 (26.9)
80°F DB, 66.6°F WB (26.66°C DB, 19.2°C WB) 50% RH	
Total, kBTU/H (kW)	73.3 (21.5)
Sensible, kBTU/H (kW)	51.9 (15.2)
Flow Rate, GPM (l/s)	19.0 (1.2)
Pressure Drop, ft water (kPa)	52.2 (156.0)
Heat Rejection, kBTU/H (kW)	97.0 (28.4)

1. The net capacity data has fan motor heat factored in for all ratings.
2. Capacity data is factory-certified to be within 5% tolerance.

5.1.1 Operating Limits for Water/Glycol-Cooled Units

Table 34 Operating limits for water/glycol-cooled units

Models	Maximum Water Pressure psi (kPa)	Maximum Close-Off Pressure psi (kPa)	Minimum Entering Water Temperature, °F (°C)
			Design Condition
CR020RW CR019RW	230 (1586)	43.5 (300)	75 (23.8)
CR035RW	230 (1586)	43.5 (300)	

5.2 Electrical Data—Water/Glycol Models

Table 35 Electrical data—Water/glycol, 600mm (24in.) models

Voltage	CR035RW		CR020RW	
	460/3/60	208/3/60	460/3/60	208/3/60
Dehumidification, With or Without Humidifier, Reheat, Condensate Pump				
FLA	32.2	62.0	24.2	50.8
WSA	39.1	75.4	29.2	61.4
OPD	50	100	35	80
Dehumidification, Humidifier and Condensate Pump; NO Reheat				
FLA	28.4	53.8	20.4	42.6
WSA	33.4	63.1	23.5	49.1
OPD	50	100	35	70
Dehumidification and Condensate Pump; NO Reheat, NO Humidifier				
FLA	24.7	45.4	16.7	34.2
WSA	29.7	54.7	19.8	40.7
OPD	45	90	30	60
Dehumidification and Reheat; NO Condensate Pump, NO Humidifier				
FLA	31.0	59.7	23.0	48.5
WSA	37.9	73.1	28.0	59.1
OPD	50	100	35	80
Dehumidification; NO Reheat, NO Humidifier, NO Condensate Pump				
FLA	23.5	43.1	15.5	31.9
WSA	28.5	52.4	18.6	38.4
OPD	45	80	30	60

FLA = Full Load Amps; WSA = Wire Size Amps; OPD = Maximum Overcurrent Protection Device

NOTICE

Risk of exceeding line-to-ground limit. Can cause equipment damage.

- The electrically commutated (EC) motors included in 480V CR035 and CR040 units are suitable for connection to power supplies with 300V or less line to ground potential. Excess line-to-ground voltage can cause capacitor failure internal to the motors.
- Power supplies such as 480V wye with solidly grounded neutral have 277V line to ground and are acceptable.

Power supplies such as 480V wye with high-resistance (or impedance) ground, 480V delta without ground or with floating ground, 480V delta with corner ground or 480V delta with grounded center tap will exceed the 300V line-to-ground limit.

Table 36 Electrical data—CR019 air-cooled and water / glycol-cooled, 300mm (12in.) models

Voltage	FLA	WSA	OPD
With Condensate Pump			
208-230V/3Ph/60Hz	33.4	39.9	60
460V/3Ph/60Hz (Wye Connected)	16.8	20	30
Without Condensate Pump			
208-230V/3Ph/60Hz	32.5	39	60
460V/3Ph/60Hz (Wye Connected)	16.3	19.4	30

FLA = Full Load Amps; WSA = Wire Size Amps; OPD = Maximum Overcurrent Protection Device

5.2.1 Electrical Connections—Standard Features, 600mm (24in.) Water/Glycol Units

Source: DPN001884, Rev. 7, Pg. 1

- High-Voltage Connection Through the Bottom of the Electric Panel**—1-3/8" (34.9mm), 1-3/4" (44.5mm) and 2-1/2" (64mm) diameter concentric knockout.
- Low-Voltage Connection Through the Bottom of the Electric Panel**—Two knockouts, each 7/8" (22mm) diameter.
- High-Voltage Connection Through the Top of the Unit**—1-3/8" (34.9mm), 1-3/4" (44.5mm) and 2-1/2" (64mm) diameter concentric knockout.
- Low-Voltage Connection Through the Top of the Unit**—Four knockouts, each 7/8" (22mm) diameter.
- Three-Phase Electrical Service**—Connect to terminals on disconnect switch. Three-phase service not by Emerson. Refer to **7.6.3 - Important Note for 460V-Rated Liebert CRV Units (CR*****A)**.
- Factory-Installed Locking Disconnect Switch**
- Earth Ground**—Terminal for field-supplied earth grounding wire.
- Remote Unit Shutdown**—Replace existing jumper between Terminals 37 and 38 with field-supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field-supplied Class 1 wiring.
- Customer Alarm Inputs**—Terminals for field-supplied, normally closed contacts having a minimum 75VA, 24VAC rating between Terminals 3 and 50, Terminals 2 and 51, Terminals 5 and 55 or Terminals 3 and 56. Use field-supplied Class 1 wiring. Terminals 3 and 56 are used for humidifier alarm when a humidifier is installed. The remaining terminals are available for customer alarm inputs, such as smoke sensors and building fire alarms.
- Common Alarm**—On any alarm, normally open dry contact is closed across Terminals 75 and 76 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
- Heat Rejection Interlock**—On any call for compressor operation, normally open dry contact is closed across Terminals 70 and 71 to heat rejection equipment. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
- CANbus Connector**—Terminal block with Terminals 49-1 (CAN-H) and 49-3 (CAN-L) + SH (shield connection). The terminals are used to connect the CANbus communication cable (provided by others) from the indoor unit to the Liebert MC, Premium model.
CANbus Cable—CANbus cable provided by others to connect to the outdoor condenser. No special considerations are required when the total external cable connection between the indoor unit and outdoor unit(s) is less than 450 ft. (137m). A CANbus isolator is required for total external cable connections greater than 450 ft. (137m) but less than 800 ft. (243m). Cable must meet the following specifications:

- Conductors: 22-18AWG stranded tinned copper
- Twisted pair (minimum four twists per foot [305mm])
- Braided shield or foil shield with drain wire
- Low capacitance: 15pF/ft or less
- UL-approved temperature rated to 167°F (75°C)
- UL-approved voltage rated to 300V
- UV-resistant and moisture-resistant if not run in conduit
- Plenum rated: NEC type CMP, if required by national or local codes

Examples: Belden 89207 (plenum rated), or Alpha Wire 6454 Category 5, 5E or higher

5.2.2 Electrical Connections—Optional Features, 600mm (24in.) Water/Glycol Units

Source: DPN001884, Rev. 7, Pg. 1

- 13. Condensate Pump High Water Alarm** (available when optional pump is installed)—On pump high-water indication, normally open dry contact is closed across Terminals 88 and 89 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
- 14. Liebert Liqui-tect® Shutdown and Dry Contact** (available when optional Liebert Liqui-tect sensor is installed)—On Liebert Liqui-tect activation, normally open dry contact is closed across Terminals 58 and 59 for remote indication. The Liebert Liqui-tect sensor notifies the Liebert iCOM® of indication through Terminals 60 and 61. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
- 15. Reheat and Humidifier Lockout**—Remote 24VAC required at Terminals 82 and 83 for lockout of reheat and humidifier.
- 16. Additional Common Alarm**—On any alarm, one additional normally open dry contact is closed across Terminals 94 and 95 for remote indication. 1A, 24VAC maximum load. Use Class 1, field-supplied wiring.



NOTE

Refer to specification sheet for total unit full load amps, wire size amps and maximum overcurrent protective device size.

NOTICE

Risk of improper input power. Can cause equipment damage.

The electronically commutated motors included in the Liebert CRV—including in 480V CR035 and CR040 units—are suitable for connection to an electrical service providing input power to the unit with 300V or less line-to-ground potential only.

Acceptable Unit Input Electrical Service for 460V (480V) Nominal Units

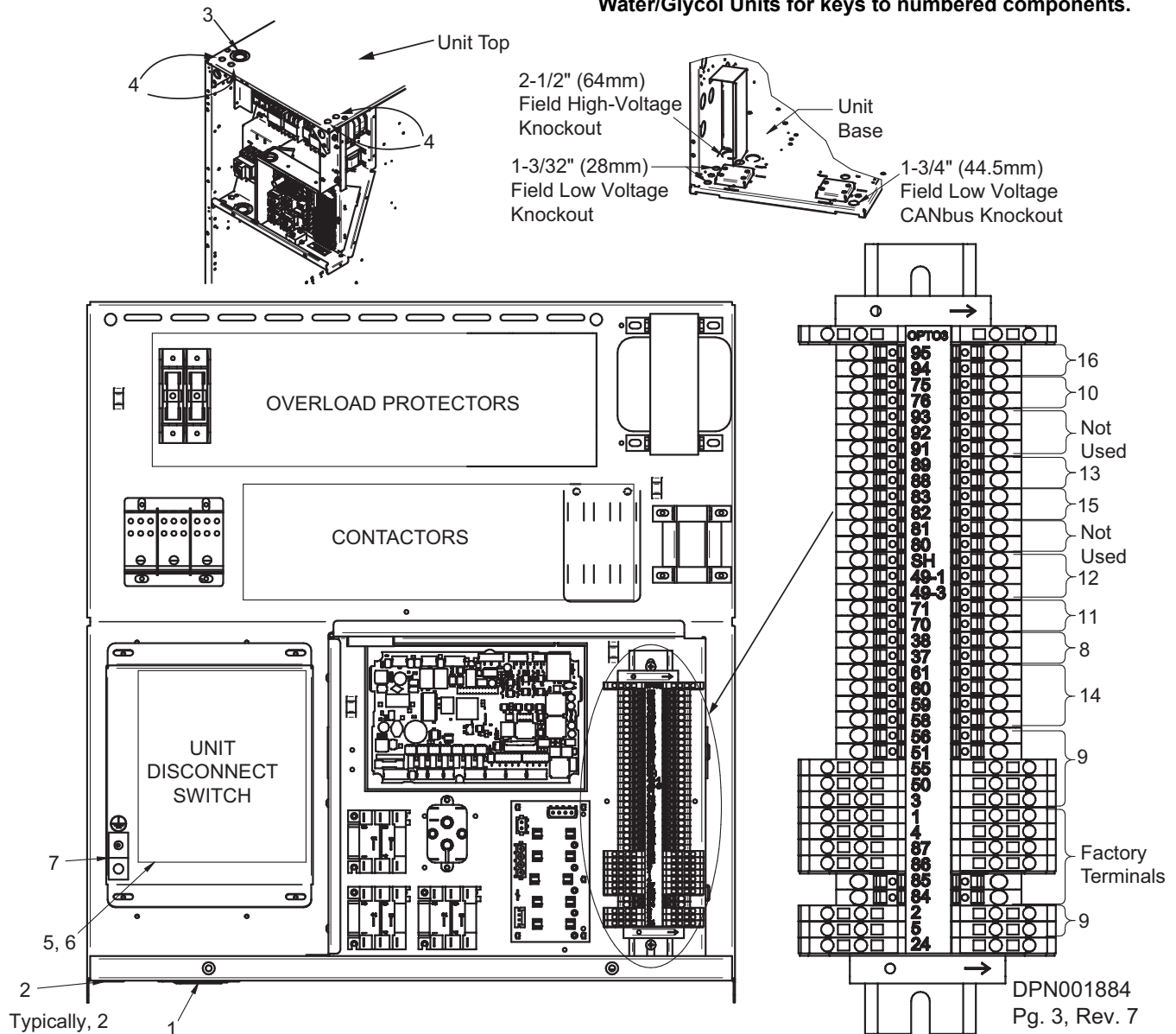
- 480V wye with solidly grounded neutral and 277V line-to-ground

Unacceptable Unit Input Electrical Service for 460V (480V) Nominal Units

- Wye with high resistance (or impedance) ground
- Delta without ground or with floating ground
- Delta with corner ground
- Delta with grounded center tap

Figure 39 Electrical field connection locations—600mm (24in.) water/glycol units

Refer to 5.2.1 - Electrical Connections—Standard Features, 600mm (24in.) Water/Glycol Units and 5.2.2 - Electrical Connections—Optional Features, 600mm (24in.) Water/Glycol Units for keys to numbered components.



5.2.3 Electrical Connections—Standard Features, 300mm (12in.) Water/Glycol Units

Source: DPN002810, Rev. 5, Pg. 1

1. **High-Voltage Connection Through the Rear of the Disconnect Switch Box**—1-1/8" (28.6mm) and 1-3/4" (44.5mm) diameter concentric knockout.
2. **High-Voltage Connection Through the Top of the Unit**—1-1/4" (32mm) and 1-3/4" (44mm) diameter concentric knockout.
3. **Electrical Service** (hard wired)—Refer to serial tag for unit electrical service requirements.
Three phase: 208/230V 60Hz
Three Phase with Neutral: 460V 60Hz Wye (5 wire: 3 phase + neutral + ground).
Single phase: 208/230V 60Hz (Chilled Water only).
 Connect to terminals on disconnect switch. Electrical service not by Emerson. Use copper conductors only. Wire per local codes. Refer to specification sheet for total unit full load amps, wire size amps and maximum overcurrent protective device size.
4. **Electrical Service** (cord connected)—Refer to serial tag for unit electrical service requirements.
Single phase: 120V 60Hz (chilled water only). 1-3/4" (44mm) diameter knockout provided in the top and bottom of the unit for the power cord to exit the unit. The power cord is factory-supplied with an L5-20 plug.
5. **Factory-Installed locking Disconnect Switch**
6. **Earth ground**—Terminal for field-supplied earth grounding wire.
7. **Low-Voltage Connection Through the Bottom of the Unit**—Two knockouts, each 7/8" (22mm) diameter, not shown.
8. **Low-Voltage Connection Through the Top of the Unit**—Two knockouts, each 7/8" (22mm) diameter knockouts.
9. **Remote Unit Shutdown**—Replace existing jumper between Terminals 37 and 38 with field-supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field-supplied Class 1 wiring.
10. **Customer Alarm Inputs**—Terminals for field supplied, normally closed contacts, having a minimum 75VA, 24VAC rating, between Terminals 3 and 50, Terminals 2 and 51, Terminals 5 and 55 or Terminals 3 and 56. Use field-supplied Class 1 wiring. Terminals 5 and 55 not available when optional condensate pump is installed.
11. **Common Alarm**—On any alarm, normally open dry contact is closed across Terminals 75 and 76 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
12. **Heat Rejection Interlock**—On any call for compressor operation, normally open dry contact is closed across Terminals 70 and 71 to heat rejection equipment. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
13. **CANbus Connector**—Terminal block with terminals 49-1 (CAN-H) and 49-3 (CAN-L) + SH (shield connection). The terminals are used to connect the CANbus communication cable (provided by others) from the indoor unit to the Liebert Microchannel Condenser, Premium Model.
CANbus Cable—CANbus cable provided by others to connect to the outdoor condenser. No special considerations are required when the total external cable connection between the indoor unit and outdoor unit(s) is less than 450 ft. (137m). A CANbus isolator is required for total external cable connections greater than 450 ft. (137m) but less than 800 ft. (243m). Cable must meet the following specifications:
 - Conductors 22-18AWG stranded tinned copper
 - Twisted pair (minimum four twists per foot [305mm])
 - Braided shield or foil shield with drain wire
 - Low Capacitance (15pF/FT or less)
 - UL approved temperature rated to 167°F (75°C)
 - UL approved voltage rated to 300V
 - UV-resistant and moisture-resistant if not run in conduit
 - Plenum rated NEC type CMP, if required by national or local codes**Examples:** Belden 89207 (Plenum Rated) or Alpha Wire 6454 Category 5, 5E or higher

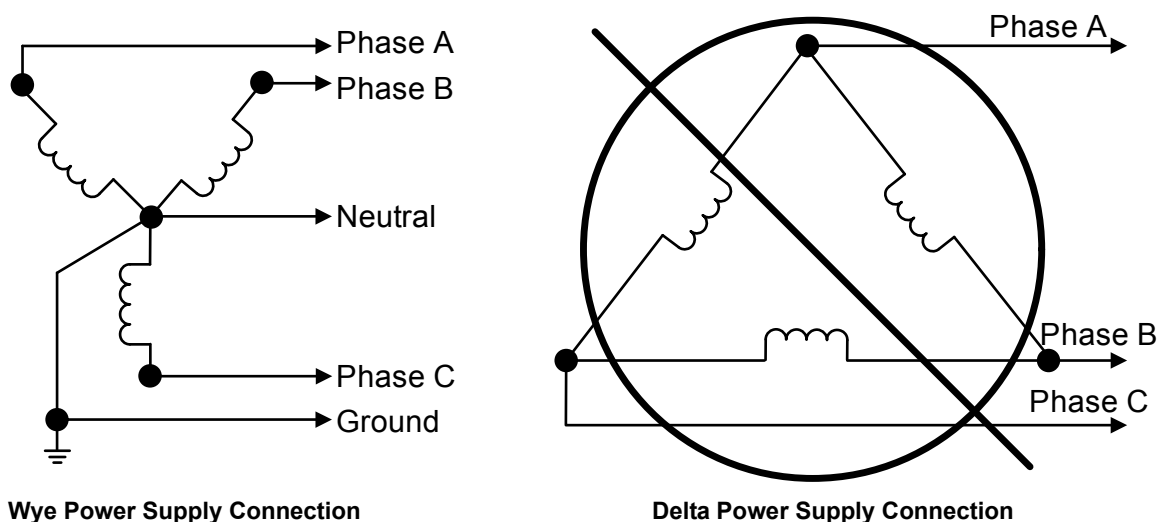
5.2.4 Electrical Connections—Optional Features, 300mm (12in.) Water/Glycol Units

Source: DPN002810, Rev. 5, Pg. 1

14. **Condensate Pump High Water Alarm** (available when optional pump is installed)—On pump high-water indication, normally open dry contact is closed across Terminals 88 and 89 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
15. **Liebert Liqui-tect® Shutdown and Dry Contact** (available when optional Liebert Liqui-tect sensor is installed)—On Liebert Liqui-tect activation, normally open dry contact is closed across Terminals 58 and 59 for remote indication. The Liebert Liqui-tect sensor notifies the Liebert iCOM® of indication through Terminals 60 and 61. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
16. **Additional Common Alarm**—On any alarm, one additional normally open dry contact is closed across Terminals 94 and 95 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.

5.2.5 Wye vs. Delta Connection Power Supply for 460V 300mm (12in.) Water/Glycol-Cooled Models

Figure 40 Wye vs. delta power supply connection diagram



NOTICE

Risk of improper input power. Can cause equipment damage.

The Liebert CRV 300 mm (12in.) 460V unit is designed to operate with wye-connected power with a solidly grounded neutral.

The 460V model will not operate properly with delta-connected power. A field-supplied isolation transformer or other power solutions will be needed for proper function.

Acceptable Power Supplies—480V Nominal Units

- 480V wye with solidly grounded neutral and 277V line-to-ground

Unacceptable Power Supplies—480V Nominal Units

- Wye with high-resistance (or impedance) ground
- Delta without ground or with floating ground
- Delta with corner ground
- Delta with grounded center tap

5.3 Dimensions—Water/Glycol Systems

Figure 41 Cabinet and floor planning dimensions—Water/glycol-cooled, 600mm (24in.) wide models

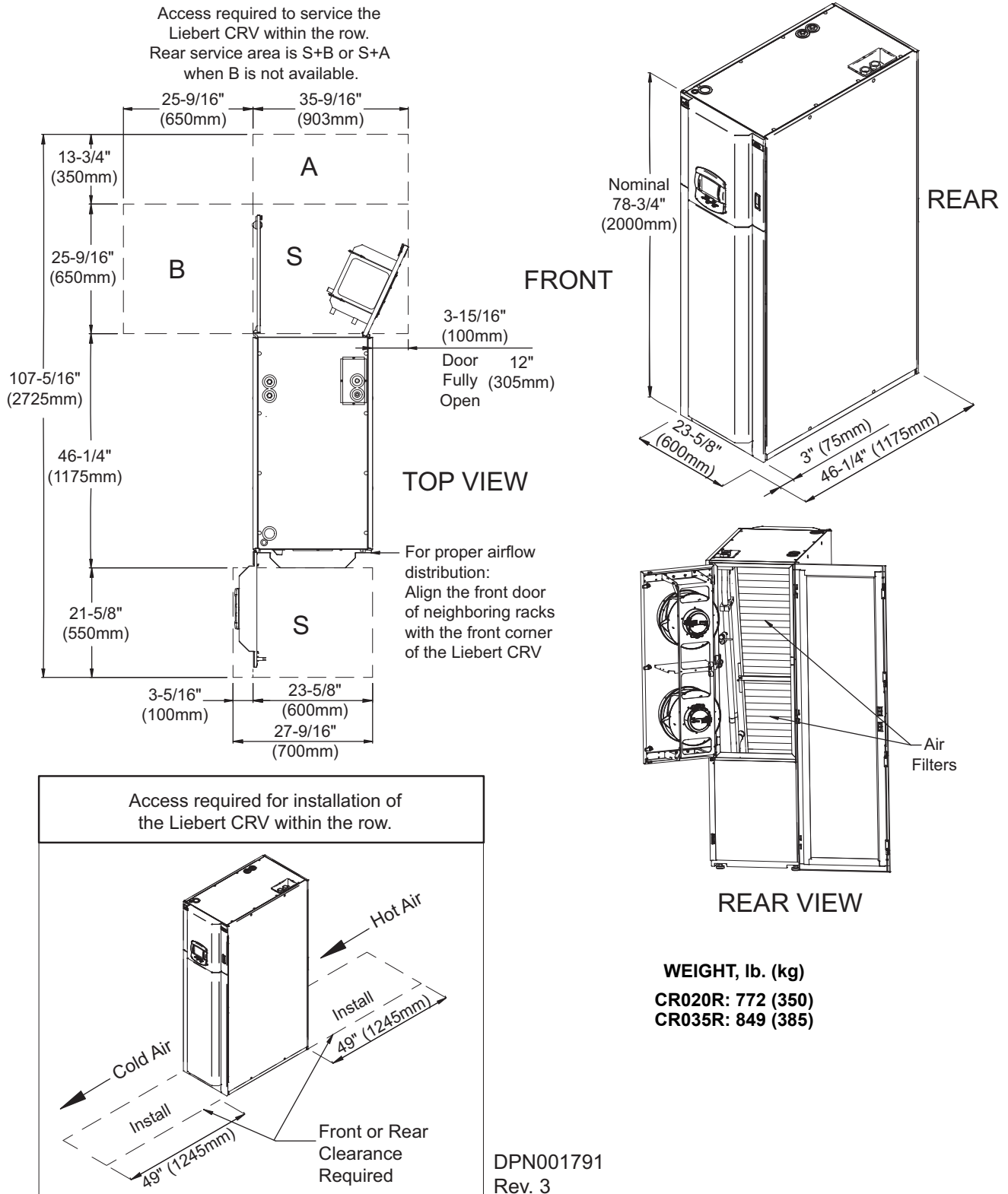
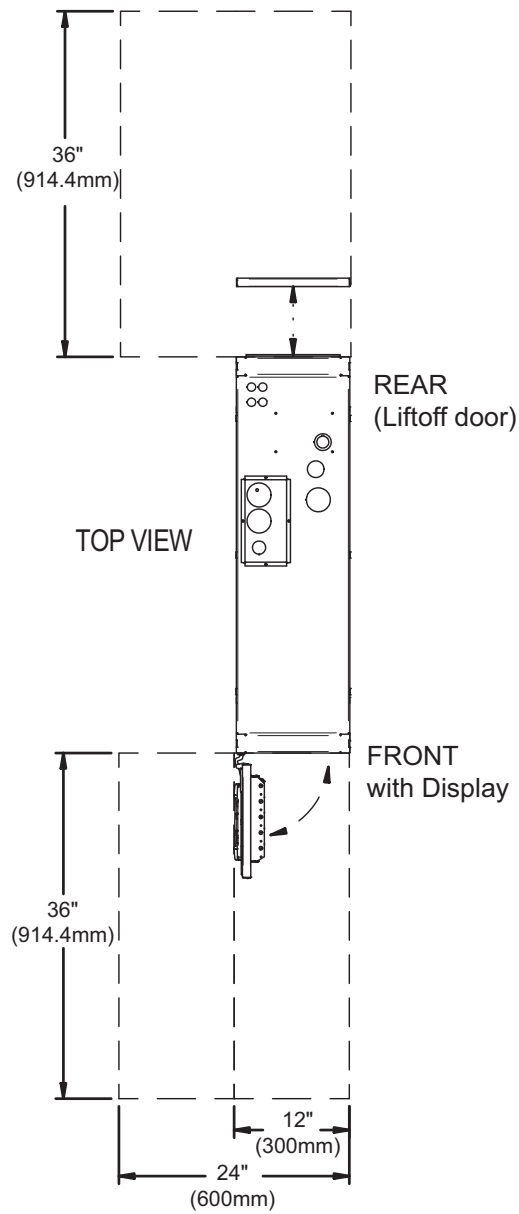


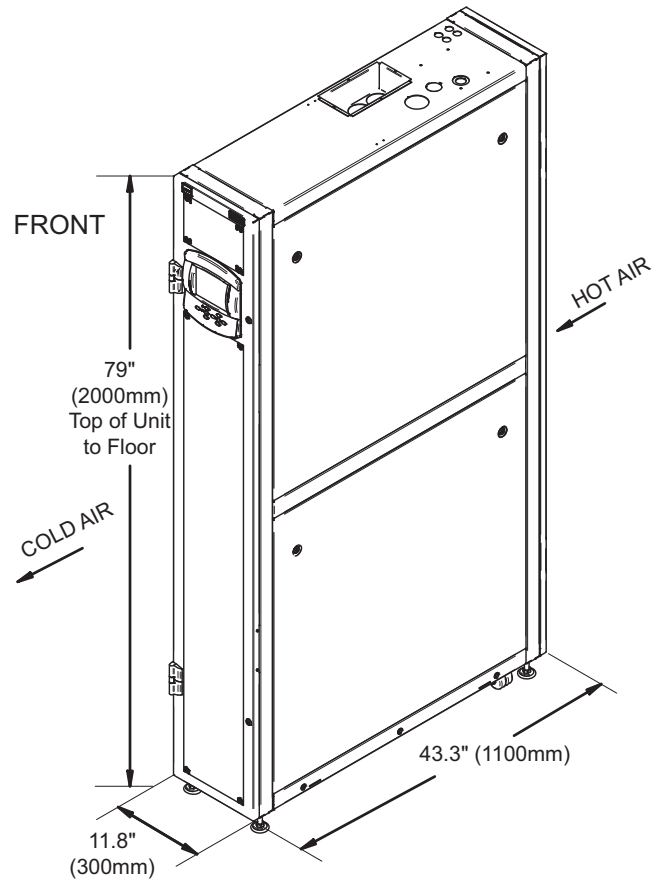
Figure 42 Cabinet and floor planning dimensions—Water/glycol-cooled, 300mm (12in.) wide models

Access Required to Service the Unit
Between Existing Racks Within the Row

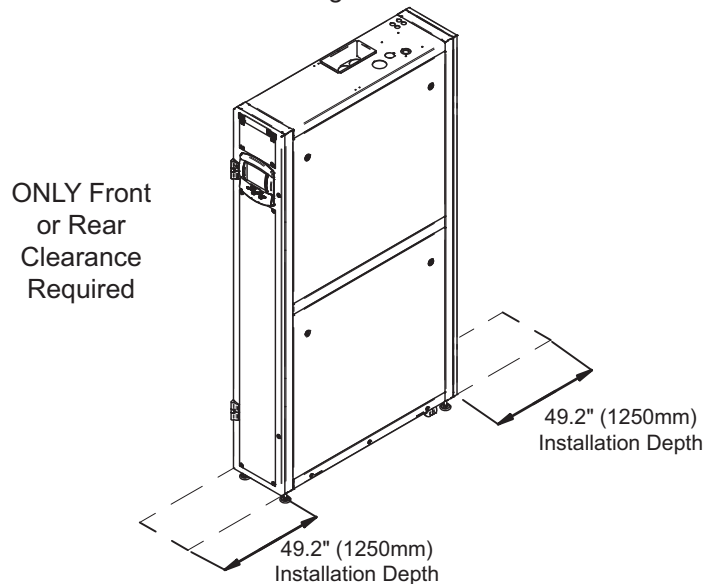


WEIGHT, lb. (kg)
247 (545)

DPN002807
Rev. 4

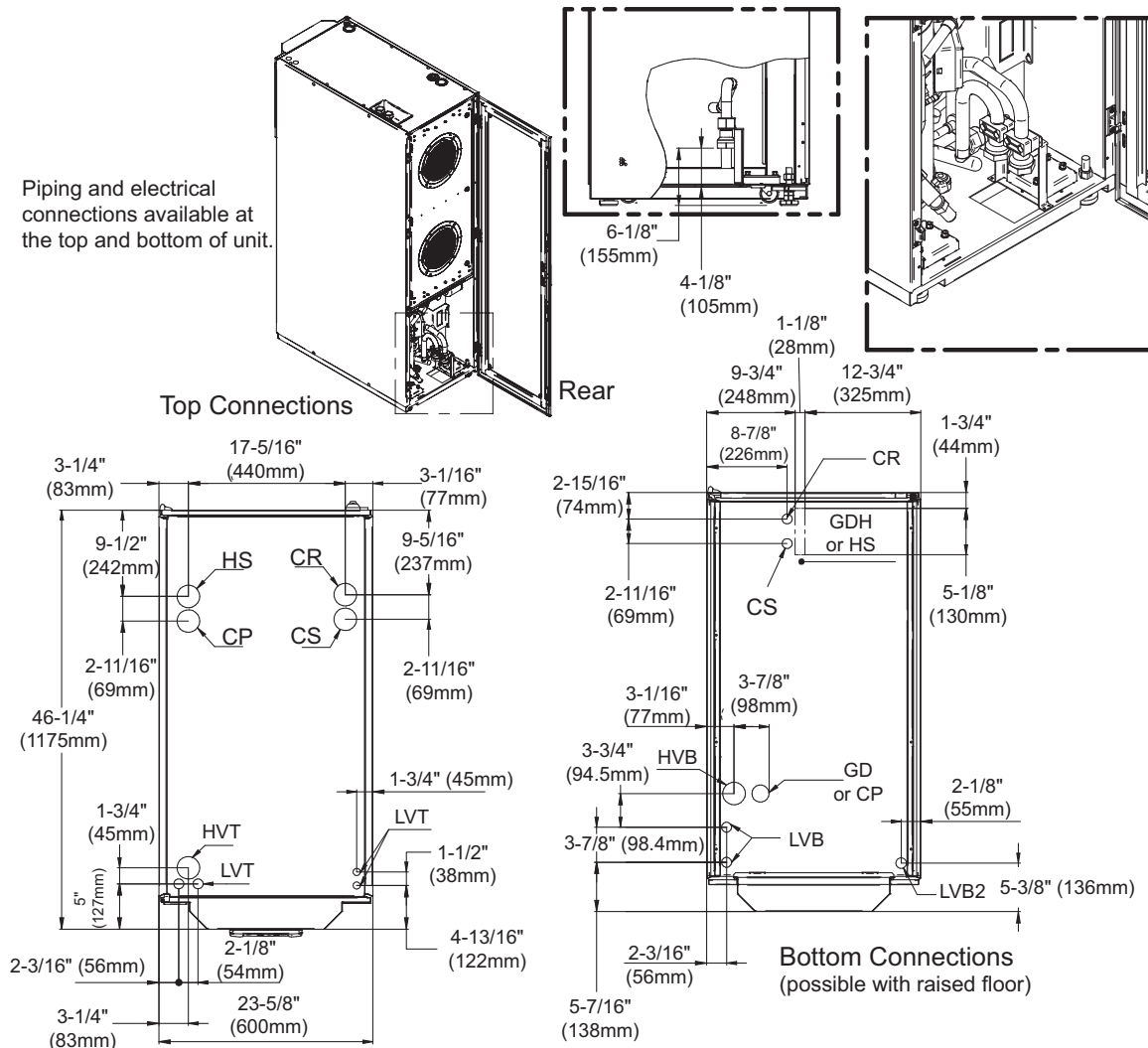


Access Required to Install the Unit
Between Existing Racks Within the Row



5.4 Piping—Water/Glycol Systems

Figure 43 Piping connections, 600mm (24in.) wide water/glycol-cooled models

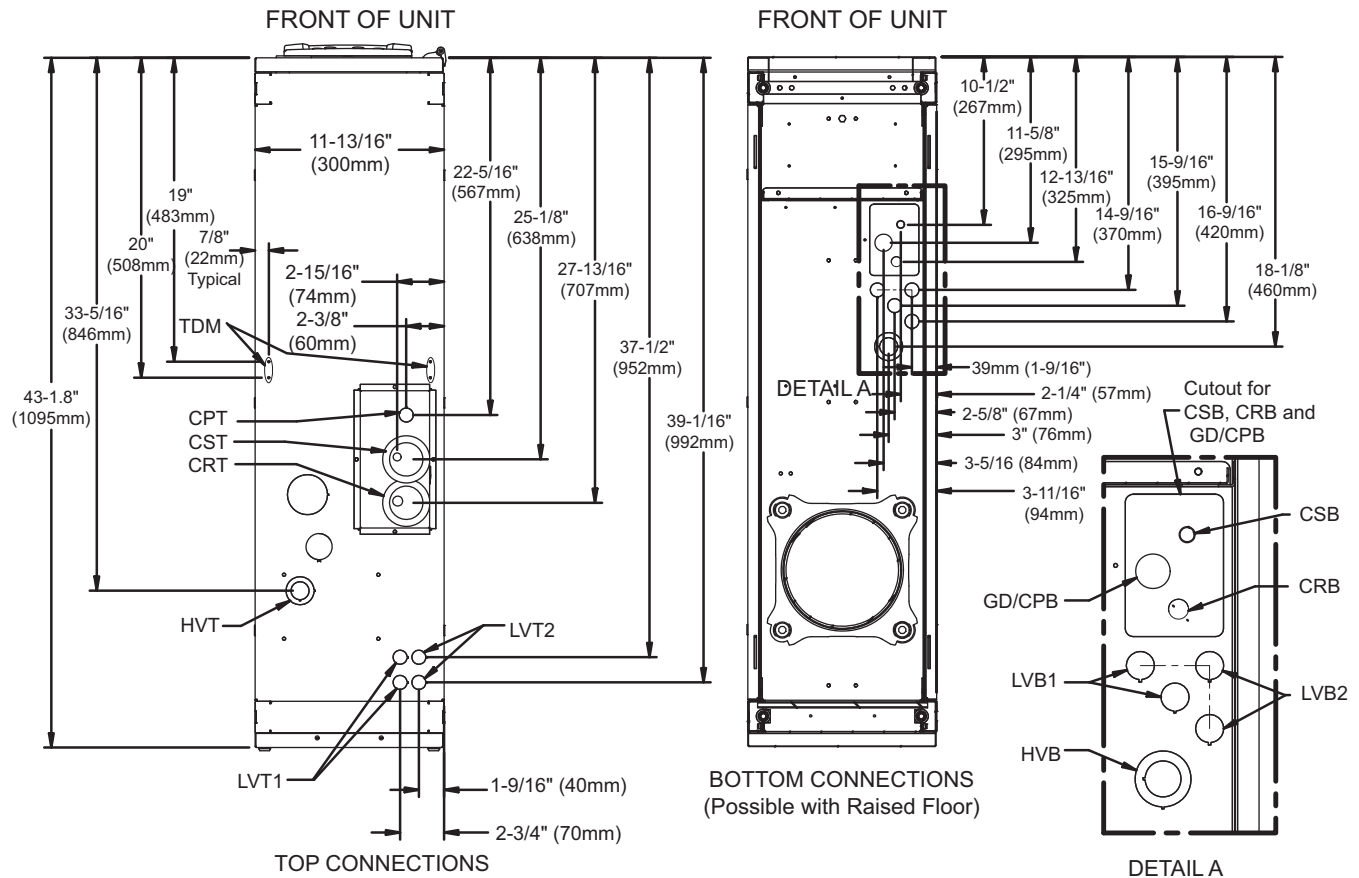


* Install a 35 mesh strainer, in an easily accessible location, on the Water/Glycol Supply to prevent particles from entering the heat exchanger. Strainer bypass valves are recommended to allow the strainer to be cleaned while maintaining flow to the cooling unit.

DPN001793
Rev. 3

Unit Connections		CR20W, CR35W, 60Hz	CR20W, CR35W, 50Hz
CS	Water/Glycol Coolant Supply	1-1/4" FPT	32mm GAS F
CR	Water/Glycol Coolant Return	1-1/4" FPT	32mm GAS F
GD	Gravity Coil Pan Drain	1" MPT	20mm I.D.
GDH	Gravity Humidifier Drain	—	22mm I.D.
HS	Humidifier Supply	1/2" FPT (top connection) 1/4" Compression Fitting (bottom connection)	1/2" GAS F (top connection), 3/4" GAS F (bottom connection)
CP	Condensate Pump	1/2" FPT	1/2" GAS F
HVT	High-Voltage Top Connection	Combination Knockout Hole Diameter 1-3/8", 1-3/4" and 2-1/2" (35mm, 44.5mm, 63.5mm)	Combination Knockout Hole, Diameter 35mm, 44.5mm and 63.5mm (1-3/8", 1-3/4", 2-1/2")
HVB	High-Voltage Bottom Entrance (feed through the base of the unit)	Knockout Hole, Diameter, 2-1/2" (63.5mm)	Knockout Hole, Diameter 63.5mm (2-1/2")
LVT	Low-Voltage Top Connection	4 Knockout Holes, Diameter 7/8" (22mm)	2 Knockout Holes, Diameter, 22mm (7/8")
LVB	Low-Voltage Bottom Entrance (feed through the base of the unit)	2 Knockout Holes, Diameter, 1-3/32" (27.8mm)	2 Knockout Holes, Diameter, 28mm (1-7/64")
LVB2	Low-Voltage Bottom Entrance (feed through the base of the unit)	Knockout Hole, Diameter, 1-3/4" (44.5mm)	—

Source DPN001793, Rev. 3

Figure 44 Piping connections, 300mm (12in.) wide water/glycol-cooled models


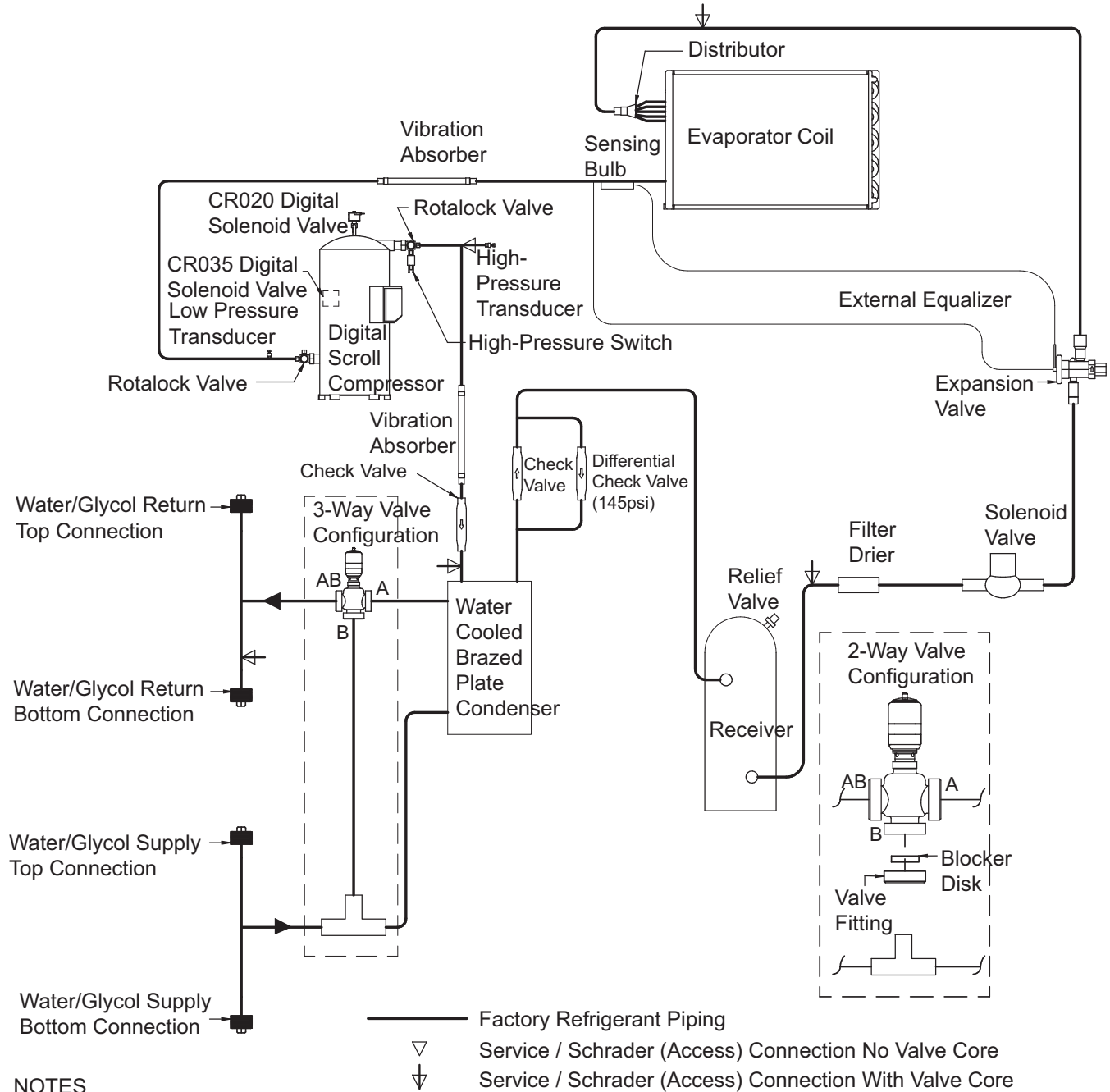
Piping connection locations must be ordered top or bottom.
Electrical connections available top or bottom of unit.

DPN003040
Rev. 2

Top Connections		CR019 (60Hz)	Bottom Connections		CR019 (60Hz)
CST	Water/Glycol Water Supply	1-1/4" FPT	CSB	Water/Glycol Water Supply	1-1/4" FPT
CRT	Water/Glycol Water Return	1-1/4" FPT	CRB	Water/Glycol Water Return	1-1/4" FPT
CPT	Condensate Pump	Knockout, 1-3/8" (35mm)	GD	Gravity Coil Pan Drain	1 Knockout Hole, Diameter 1-3/4" (44mm)
HVT	High-Voltage Top Connection	Combination Knockout 1-1/8" and 1-3/4" (29mm and 44mm)	CPB	Condensate Pump	
LVT1	Low-Voltage Top Connection (Twisted Pair)	2 Knockout Holes Diameter 7/8" (22mm)	HVB	High-Voltage Bottom Entrance (feed through the base of the unit)	Combination Knockout 1-1/8" and 1-3/4" (29mm and 44mm)
LVT2	Low-Voltage Top Connection (Shielded Cable)	2 Knockout Holes Diameter 7/8" (22mm)	LVB1	Low-Voltage Bottom Connection (Twisted Pair)	2 Knockout Holes Diameter, 7/8" (22mm)
TDM	Tie-Down Mounting (Top)	4 Holes, Diameter 1/8" (3mm)	LVB2	Low-Voltage Bottom Connection (Shielded Cable)	2 Knockout Holes Diameter, 7/8" (22mm)

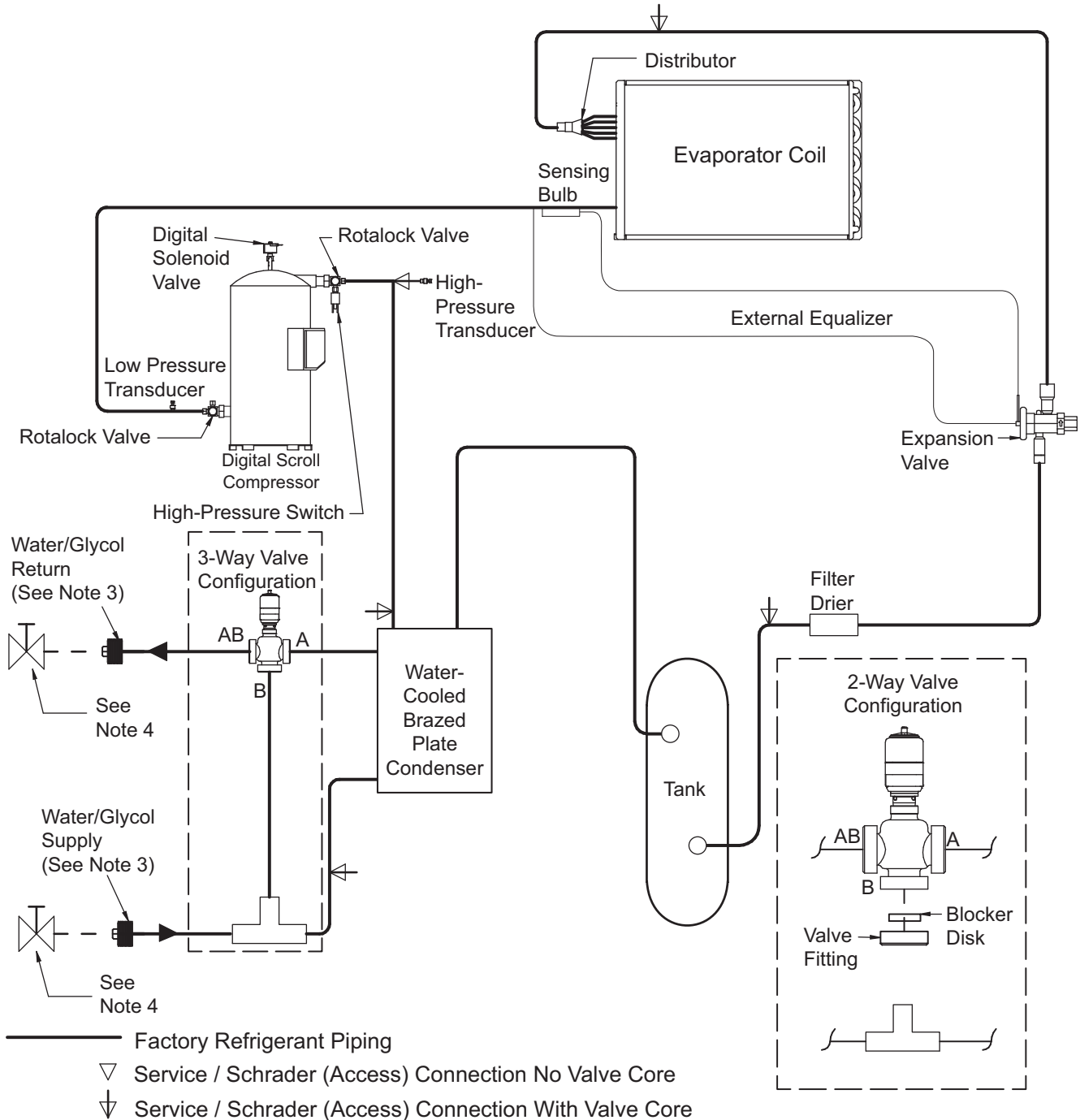
Source: DPN003040, Rev. 2

Figure 45 General arrangement diagram—Water/glycol 600mm (24 in.) models



DPN001985
Rev. 1

Figure 46 General arrangement diagram—Water/glycol 300mm (12 in.) models



Notes:

1. Schematic representation shown. Do not use for specific connection locations.
2. Install a 35 mesh strainer, in an easily accessible location, on the water/glycol supply to prevent particles from entering the heat exchanger. Strainer bypass valves are recommended to allow the strainer to be cleaned while maintaining flow to the cooling unit.
3. Unit connections may be ordered top or bottom.
4. Valves not provided by Emerson but are required for proper circuit operation and maintenance. They should be installed near the Liebert CRV.

DPN003039
Rev. 0

5.5 Sound Data—Water Glycol Systems

Table 37 Sound data—Model CR020RW, CR035RW 600mm (24in.) water/glycol model

2 Fans with Filter			Sound Power Level (PWL)										Sound Pressure Level (SPL)
Fan Speed %	Airflow		Octave Band Frequency (Hz)									A-Scale Weighted dB (A)	Suction Side 2m distance, free field conditions (2m, f.f, dBA)
	SCFM	m³/h	31.5 dB	63 dB	125 dB	250 dB	500 dB	1000 dB	2000 dB	4000 dB	8000 dB		
100	2454	4170	73.8	69.4	71	77.3	75.9	74.2	73.5	68.2	59.2	79.6	69.2
75	2166	3680	71.2	66.8	68.4	74.7	73.3	71.6	70.9	65.6	56.6	77	66.9
50	1780	3025	67.6	63.2	64.8	71.1	69.7	68	67.3	62	53	73.4	63.9

Level PWL sound power level

Table 38 Sound data—Model CR019RA, 300mm (12in.) water/glycol

5 Fans With Filter			Sound Power Level (PWL)											Sound Pressure Level (SPL)		
Fan Speed %	Airflow		Octave Band Frequency (Hz)									A-Scale Weighted dB (A)	Inlet dB (A)	Outlet dB (A)	Suction Side 2m Distance, 1.5m Above Ground Free Field Conditions (2m, f.f, dBA)	Discharge Side 2m Distance, 1.5m Above Ground Free Field Conditions (2m, f.f, dBA)
	SCFM	m³/h	31.5 dB	63 dB	125 dB	250 dB	500 dB	1000 dB	2000 dB	4000 dB	8000 dB					
100	2610	4435	—	—	72.2	82.3	81.5	81.2	78.1	70.2	64.7	85.4	76.7	82.6	65.7	71.6
75	2250	3823	—	—	69.7	9	79.1	77.4	73.9	65.9	62.3	81.6	72.7	79.9	61.8	68.9
50	1615	2744	—	—	71.1	66.1	67.2	65.1	59.5	55.2	51.8	69.4	62	70.2	51	59.2

5.6 Standard Features—600mm (24in.) Water/Glycol Systems

Source: DPN001905, Rev. 3

DX Cooling Coil—The evaporator coil has 7.25 ft² (0.674 m²) face area, four or five rows deep. It is constructed of copper tubes and hydrophilic coated aluminium fins. The hydrophilic coating provides superior water carryover resistance. Two stainless steel condensate drain pans are provided.

Refrigeration System—Single refrigeration circuit includes a liquid line filter dryer, an adjustable externally equalized expansion valve, and a liquid line solenoid valve.

Compressor—The compressor is an R-410A scroll-type with variable capacity operation from 20-100%; commonly known as a *digital scroll*. Compressor solenoid valve unloads the compressor to provide variable capacity operation. The compressor has a suction gas cooled motor, vibration isolators, internal thermal overloads, manual reset high pressure switch, rotalock service valves, low pressure and high pressure transducer, crankcase heater, internal centrifugal oil pump, and an operating speed of 3500 rpm @ 60Hz (2900 rpm @ 50Hz).

Fan—The unit is equipped with two plug fans: direct driven centrifugal fans with backward curved blades and electronically commutated DC motors; commonly referred to as *EC plug fans*. The fan speed is variable and automatically regulated by the Liebert iCOM® through all modes of operation. Each fan has a dedicated motor and speed controller, which provides a level of redundancy. The fans push air through the coil and are located on the rear panel of the unit.

Water/Glycol Condenser—Is an efficient, stainless steel, brazed-plate condenser. Waterside threaded connections are provided for convenience. Proper filtration must be field-supplied when used on open-loop water systems (cooling towers, etc). Emerson recommends using a water/glycol mixture when operating on a closed-loop to avoid undesired ice formation in the winter.

Three-Way Modulating Valve—A three-way modulating valve controls the water/glycol flow through the brazed-plate condenser. The Liebert iCOM manages the valve actuator movement to maintain the desired condensing temperature for various entering water temperatures. The maximum differential pressure across the closed valve is 43.5 PSI (300 kPa). Maximum system pressure is 230 PSI (1586 kPa).

Supply Air Baffle—A field-adjustable, modular supply air baffle is located in the discharge airstream. It can be quickly and easily configured to redirect airflow. The angles of the vanes have been optimized to effectively distribute air to heat-generating equipment in a variety of applications.

Liebert iCOM® Control System—The Liebert CRV is controlled by the Liebert iCOM. The standard user interface is the Large Graphical Display (320x240 pixels, backlit), which presents system information and allows all parameters to be viewed and adjusted. It features push-button navigation, operational status LEDs, and a three-level password protection system. Unit-to-Unit communication with other Liebert CRV's and two Liebert IntelliSlot™ communication card housings are included as standard.

2T Rack Temperature Sensors—Each consists of a vented case with two temperature probes. Three 2T rack sensors are standard with each Liebert CRV. Up to ten 2T housings (20 temperature probes) can be connected to a Liebert CRV. One 2T housing and both sensor probes are to be attached to a rack that the cooling unit is conditioning. The sensors provide real-time, direct feedback to the cooling unit to optimize the amount of cooling and airflow required, increasing energy efficiency and ensuring proper rack inlet air temperatures. The sensor data can also be reported to remote BMS and monitoring systems. The sensor network consists of one CAN wire leaving the cooling unit and connecting to a 2T sensor. Each remaining 2T sensor is connected to the previous sensor in a daisy-chain configuration.

Remote Shutdown Terminal—Provides a location to remotely shut down the unit.

Common Alarm Contact—Provides a set of normally open (N/O) contacts for remote indication of unit alarms.

Cabinet—The exterior steel panels are custom powder-coated to protect against corrosion. The double-wall constructed side panels separate the half-inch, 2.0 lb/ft³ insulation from the airstream. The unit is mounted on casters for quick installation and provided with leveling feet. The perforated inlet and outlet panels have 81% open area. The rear door utilizes a Knürr rack-style handle and hinges.

Service Access—All service and maintenance is performed through the front or rear of the unit, including any component removal. No side access is required. All electrical and piping connections are made through the top and/or bottom of the unit. All units are provided with a superior service access panel to provide additional access.

Filter—The unit is equipped with two deep-pleated four-inch filters rated MERV8 (based on ASHRAE 52.2-2007), located within the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

Locking Disconnect Switch—A molded-case circuit interrupter disrupts the flow of power to the unit. The electric panel high-voltage compartment can be accessed only with the switch in the Off position. The switch is behind the Liebert iCOM® display door for quick access.

65,000A Short Circuit Current Rating (SCCR)—The electrical panel provides a 65k amp SCCR.

5.7 Optional Features—600mm (24in.) Water/Glycol Systems

Source: DPN001905, Rev. 3

DX Cooling Coil—The evaporator coil has 7.25 ft² (0.674 m²) face area, four or five rows deep. It is constructed of copper tubes and hydrophilic coated aluminium fins. The hydrophilic coating provides superior water carryover resistance. Two stainless steel condensate drain pans are provided.

Refrigeration System—Single refrigeration circuit includes a liquid line filter dryer, an adjustable externally equalized expansion valve, and a liquid line solenoid valve.

Compressor—The compressor is an R-410A scroll-type with variable capacity operation from 20-100%; commonly known as a *digital scroll*. Compressor solenoid valve unloads the compressor to provide variable capacity operation. The compressor has a suction gas-cooled motor, vibration isolators, internal thermal overloads, manual reset high pressure switch, rotalock service valves, low-pressure and high-pressure transducer, crankcase heater, internal centrifugal oil pump and an operating speed of 3500 rpm @ 60Hz (2900 rpm @ 50Hz).

Fan—The unit is equipped with two plug fans: direct-driven centrifugal fans with backward-curved blades and electronically commutated DC motors; commonly referred to as *EC plug fans*. The fan speed is variable and automatically regulated by the Liebert iCOM® through all modes of operation. Each fan has a dedicated motor and speed controller, which provides a level of redundancy. The fans are on the unit's rear panel and push air through the coil.

Water/Glycol Condenser—Is an efficient, stainless steel, brazed-plate condenser. Water-side threaded connections are provided for convenience. Proper filtration must be field-supplied when used on open-loop water systems (cooling towers, etc). Emerson recommends using a water/glycol mixture when operating on a closed-loop to avoid undesired ice formation in the winter.

Three-way Modulating Valve—A three-way modulating valve controls the water/glycol flow passing through the brazed-plate condenser. The Liebert iCOM manages the valve actuator movement to maintain the desired condensing temperature for various entering water temperatures. The maximum differential pressure across the closed valve is 43.5 PSI (300 kPa). Maximum system pressure is 230 PSI (1586 kPa).

Supply Air Baffle—A field-adjustable, modular supply air baffle is located in the discharge air stream. It can be quickly and easily configured to redirect airflow. The angles of the vanes have been optimized to effectively distribute air to heat generating equipment in a wide variety of applications.

Liebert iCOM Control System—The Liebert CRV is controlled by the Liebert iCOM. The standard user interface is the large graphical display (320x240 pixels, backlit), which presents system information and allows all parameters to be viewed and adjusted. It features push-button navigation, operational status LED's and a three-level password protection system. Unit-to-Unit communication with other Liebert CRV's and two Liebert IntelliSlot communication card housings are included as standard.

2T Rack Temperature Sensors—Each consists of a vented case with two temperature probes. Three 2T rack sensors are standard with each Liebert CRV. Up to ten 2T housings (20 temperature probes) can be connected to a Liebert CRV. One 2T housing and both sensor probes are to be attached to a rack the cooling unit is conditioning. The sensors provide real-time, direct feedback to the cooling unit to optimize the amount of cooling and airflow required, increasing energy efficiency and ensuring proper rack inlet air temperatures. The sensor data can also be reported to remote BMS and monitoring systems. The sensor network consists of one CAN wire leaving the cooling unit and connecting to a 2T sensor. Each remaining 2T sensor is connected to the previous sensor in a daisy-chain configuration.

Remote Shutdown Terminal—Provides a location to remotely shut down the unit.

Common Alarm Contact—Provides a set of normally open (N/O) contacts for remote indication of unit alarms.

Cabinet—The exterior steel panels are custom powder-coated to protect against corrosion. The double-wall side panels separate the half-inch, 2.0 lb/ft³ insulation from the airstream. The unit is mounted on casters for quick installation and provided with leveling feet. The perforated inlet and outlet panels have 81% open area. The rear door utilizes a Knürr rack-style handle and hinges.

Service Access—All service and maintenance is performed through the front or rear of the unit; including any component removal. No side access is required. All electrical and piping connections are made through the top and/or bottom of the unit. All units are provided with a superior service access panel to provide additional access.

Filter—The unit is equipped with two deep-pleated 4 inch filters rated MERV8 (based on ASHRAE 52.2-2007), located within the cabinet, and accessible from the rear of the unit. A filter clog alarm is included.

Locking Disconnect Switch—A molded-case circuit interrupter disrupts the flow of power to the unit. The electric panel high-voltage compartment can be accessed only with the switch in the Off position. Conveniently located behind the Liebert iCOM display door for quick access.

65,000 Amp Short Circuit Current Rating (SCCR)—The electrical panel provides a 65k amp SCCR.

5.8 Standard Features—300mm (12in.) Water/Glycol Systems

Source: DPN003037, Rev. 1

DX Cooling Coil—The evaporator coil has 6.46 ft² (0.60 m²) face area three rows deep. It is constructed of copper tubes and hydrophilic-coated aluminum fins. The hydrophilic coating provides superior water carryover resistance. A stainless steel condensate drain pan is provided.

Refrigeration System—Single refrigeration circuit includes a liquid line filter dryer and an adjustable, externally equalized expansion valve.

Compressor—The compressor is an R-410A scroll-type with variable capacity operation from 20-100%; commonly known as a *digital scroll*. Compressor solenoid valve unloads the compressor to provide variable capacity operation. The compressor has a suction gas-cooled motor, vibration isolators, internal thermal overloads, manual reset high-pressure switch, rotalock service valves, low-pressure and high-pressure transducer, crankcase heater, internal centrifugal oil pump and an operating speed of 3500 rpm @ 60Hz (2900rpm @ 50Hz).

Fans—The unit is equipped with five plug fans: direct driven centrifugal fans with backward-curved blades and electronically commutated motors, commonly referred to as *EC plug fans*. The fan speed is variable and automatically regulated by the Liebert iCOM® through all modes of operation. Each fan has a dedicated motor and integrated speed controller, which provides a level of redundancy. The fans are in the front of the unit and pull air through the coil.

Supply Air Baffle—Field adjustable, modular supply air baffles are located in the discharge air stream. They can be quickly and easily reconfigured to redirect airflow.

Liebert iCOM®—The Liebert CRV is controlled by the Liebert iCOM. The standard user interface is the large graphical display (320x240 pixels, backlit), which presents system information and allows all parameters to be viewed and adjusted. It features push-button navigation, operational status LED's and a three-level password protection system. Unit-to-Unit communication with other Liebert CRV's and two Liebert IntelliSlot™ communication card housings are included as standard.

Water / Glycol Condenser—Stainless steel brazed-plate condenser. Water-side threaded connections are provided for convenience. Proper filtration must be field-supplied when used on open-loop water systems (such as a cooling tower). Emerson recommends using a water/glycol mixture when operating on a closed-loop to avoid ice formation in the winter.

Three-Way Modulating Valve—A three-way modulating valve controls the water/glycol flow through the brazed-plate condenser. The Liebert iCOM controls the valve actuator movement to maintain the desired condensing temperature for various entering water temperatures. The maximum differential pressure across the closed valve is 43.5 PSI (300 kPa). Maximum system pressure is 230 PSI (1586 kPa).

2T Rack Temperature Sensors—Each consists of a vented case with two temperature probes. Three 2T rack sensors are standard with each Liebert CRV. Up to ten 2T housings (20 temperature probes) can be connected to a Liebert CRV300. One 2T housing and both sensor probes are to be attached to a rack the Liebert CRV is cooling. The sensors provide real-time, direct feedback to the cooling unit to optimize the amount of cooling and airflow required, increasing energy efficiency and ensuring proper rack inlet air temperatures. The sensor data can also be reported to remote BMS and monitoring systems. The sensor network consists of one CAN wire leaving the cooling unit and connecting to a 2T sensor. Each remaining 2T sensor is connected to the previous sensor in a daisy-chain configuration.

Remote Shutdown Terminal—Provides a location to remotely shut down the unit.

Common Alarm Contact—Provides a set of normally open (N/O) contacts for remote indication of unit alarms.

Cabinet—The exterior steel panels are custom powder-coated to protect against corrosion. The unit is mounted on casters for quick installation and provided with leveling feet. The perforated inlet and outlet panels have 81% open area. The front door is hinged; the rear door may be lifted off the unit.

Service Access—All service and maintenance is performed through the front or rear of the unit, including any component removal. No side access is required. Piping connection locations must be ordered top or bottom. Electrical connections are made through the top or bottom of the unit.

Filter—The unit is equipped with two half-inch filters rated MERV1 (based on ASHRAE 52.2-2007), located within the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

Locking Disconnect Switch—A molded-case circuit interrupter disrupts the flow of power to the unit. The electric panel high-voltage compartment can be accessed only with the switch in the Off position. Located behind the rear door and filters for access.

65,000A Short Circuit Current Rating (SCCR)—The electrical panel provides a 65k amp SCCR.

5.9 Optional Features—300mm (12in.) Water/Glycol Systems

Source: DPN003038, Rev. 0

Dual-Float Condensate Pump—Capacity of 45 GPH (171 l/hr) at 13ft (4m) head. Pump is complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.

Liebert IntelliSlot™ SiteLink-E® Card (IS-485EXI)—Provides ground fault isolated connection to a Liebert SiteLink-E for monitoring and management. Compatible with Liebert SiteScan Web 4.0 or newer version.

Liebert IntelliSlot Unity™ Card (IS-UNITY-DP)—Provides ground fault isolated RS-485 Modbus, BACnet IP and Modbus IP network connectivity to Building Management Systems for unit monitoring and management. Also provides ground fault-isolated 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include: SNMP for Network Management Systems, HTTP for Web page viewing, SMTP for e-mail and SMS for messaging. Supports dual IP and 485 protocols simultaneously.

Filter—The optional filters are two deep pleated 2 inch rated MERV8 (based on ASHRAE 52.2-2007) located within the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

One Extra Common Alarm Contact—Provides two sets of normally open (N/O) contacts for remote indication of unit alarms.

Liebert Liqui-tect®—Solid-state water sensor hermetically sealed to keep out dust and dirt. The alarm system is activated when the sensor detects moisture.

Two-Way Modulating Valve—A two-way modulating valve controls the water/glycol flow through the brazed-plate condenser. The Liebert iCOM® manages the valve actuator movement to maintain the desired condensing temperature for various entering water flow rates and temperatures. The maximum differential pressure across the closed valve is 43.5 PSI (300 kPa). Maximum system pressure is 230 PSI (1586 kPa).

6.0 HEAT REJECTION—DRYCOOLERS

6.1 Liebert Drycoolers for Water/Glycol-Cooled Liebert CRV's

Liebert drycoolers are designed to work with the Liebert CRV. The drycoolers provide glycol to the Liebert CRV's internal high-efficiency brazed plate condenser to maintain proper condensing temperatures. Ethylene or Propylene glycol must be added to the water loop to prevent freezing during low outdoor temperatures. **Figure 47** shows the percentage of ethylene glycol that should be added based on the minimum outdoor temperature. If the Liebert CRV is attached to an open water loop (cooling tower, city water, etc.) a field-supplied 16-20 mesh strainer is to be installed (not supplied by Emerson) within 10 ft (30m) upstream of the unit to prevent debris from entering the unit.

Table 39 Glycol-cooled drycooler matchups

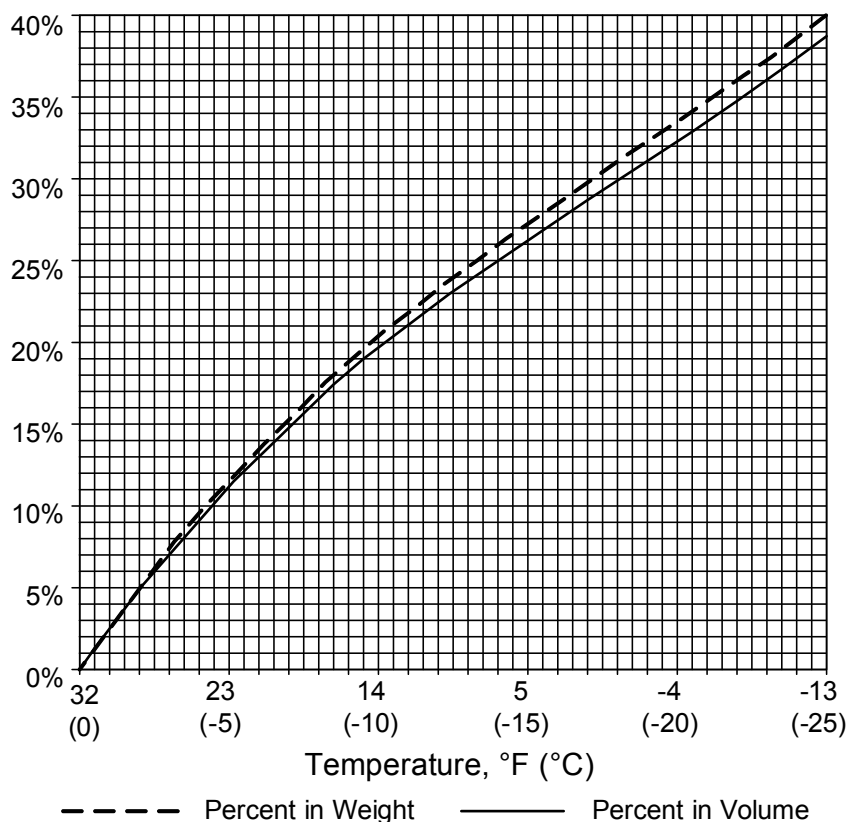
CRV Model	Outdoor Temperature, °F (°C)	# Fans	Models ¹	Suggested Pump HP ²
19kW and 20kW	95 (35)	1	DSO112*8	1.5
	100 (38)	2	DSO174*8	1.5
	105 (41)	2	DSO225*16	2
35kW	95 (35)	2	DSO197*16	2
	100 (38)	3	DSO310*16	2
	105 (41)	4	DSO419*16	3

* = A (460V / 3ph / 60Hz) —or— Y (208/230V / 3ph / 60Hz) —or— B (575V / 3ph / 60Hz)

1. Matchups sized for 40% propylene glycol

2. Suggested pump selections provide at least 30ft H₂O head for piping losses

Figure 47 Percentage of ethylene glycol mixed with water



NOTICE

Risk of freezing fluid mixture. Can cause equipment damage.

The water supply/loop must be checked periodically for proper glycol mixture content. For safety, calculate the percentage for protection at least 9°F (5°C) below the minimum ambient design temperature.

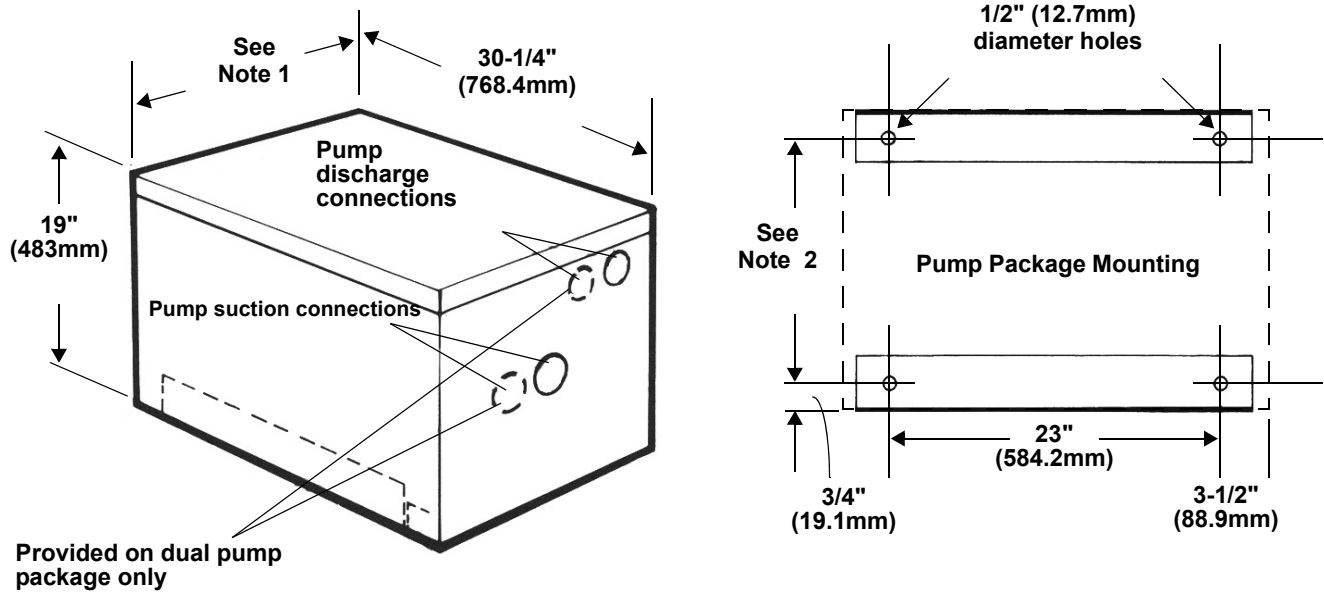
6.2 Drycooler General Data

Table 40 Drycooler electrical data

# of Fans	1				2				3				4			
Model #	112				174, 197, 225				310				419			
Pump Hp	ph	FLA	WSA	OPD	ph	FLA	WSA	OPD	ph	FLA	WSA	OPD	ph	FLA	WSA	OPD
208/230/60																
0.75	1	12.4	14.3	20	—	—	—	—	—	—	—	—	—	—	—	—
0.75	3	7.0	7.9	15	3	10.5	11.4	15	3	14.0	14.9	15	3	17.5	18.4	20
1.5	3	10.1	11.8	15	3	13.6	15.3	20	3	17.1	18.8	25	3	20.6	22.3	25
2.0	3	11.0	12.9	20	3	14.5	16.4	20	3	18.0	19.9	25	3	21.5	23.4	30
3.0	3	14.1	16.8	25	3	17.6	20.3	30	3	21.1	23.8	30	3	24.6	27.3	35
5.0	3	20.2	24.4	40	3	23.7	27.9	40	3	27.2	31.4	45	3	30.7	34.9	50
7.5	3	27.7	33.8	50	3	31.2	37.3	60	3	34.7	40.8	60	3	38.2	44.3	60
460/3/60																
0.75	3	3.3	3.7	15	3	5.0	5.4	15	3	6.7	7.1	15	3	8.4	8.8	15
1.5	3	4.7	5.5	15	3	6.4	7.2	15	3	8.1	8.9	15	3	9.8	10.6	15
2.0	3	5.1	6.0	15	3	6.8	7.7	15	3	8.5	9.4	15	3	10.2	11.1	15
3.0	3	6.5	7.7	15	3	8.2	9.4	15	3	9.9	11.1	15	3	11.6	12.8	15
5.0	3	9.3	11.2	15	3	11.0	12.9	20	3	12.7	14.6	20	3	14.4	16.3	20
7.5	3	12.7	15.5	25	3	14.4	17.2	25	3	16.1	18.9	25	3	17.8	20.6	30

6.3 Drycooler Pump Packages and Expansion Tank - Options

Figure 48 Drycooler pump package and pump mounting



Notes

1. Single pump packages are 17-1/4" (438.2mm) wide. Dual pump packages are 32-1/4" (819.2mm) wide.
2. Mounting holes are 15-11/32" (389.7mm) apart on single pump packages and 30-11/32" (770.7mm) apart on dual pump packages.
3. 7-1/2hp dimensions not shown—consult factory.

Expansion Tank- (P/N 1C16717P1)

This tank, included in a standard pump package, has an internal volume of 8.8 gal. (33 l) and a maximum pressure of 100 psi (690 kPa).

This tank is sized for a typical "open" system with a fluid volume of less than 75 gal. (280l). When used in a "closed" system, volumes of up to 140 gal. (910l) can be accommodated. The use of a safety relief valve, field-supplied, is recommended for systems "closed" to atmospheric venting. Other piping accessories for filling, venting or adjusting the fluid in the system, are recommended, but not included.

Figure 49 Expansion tank

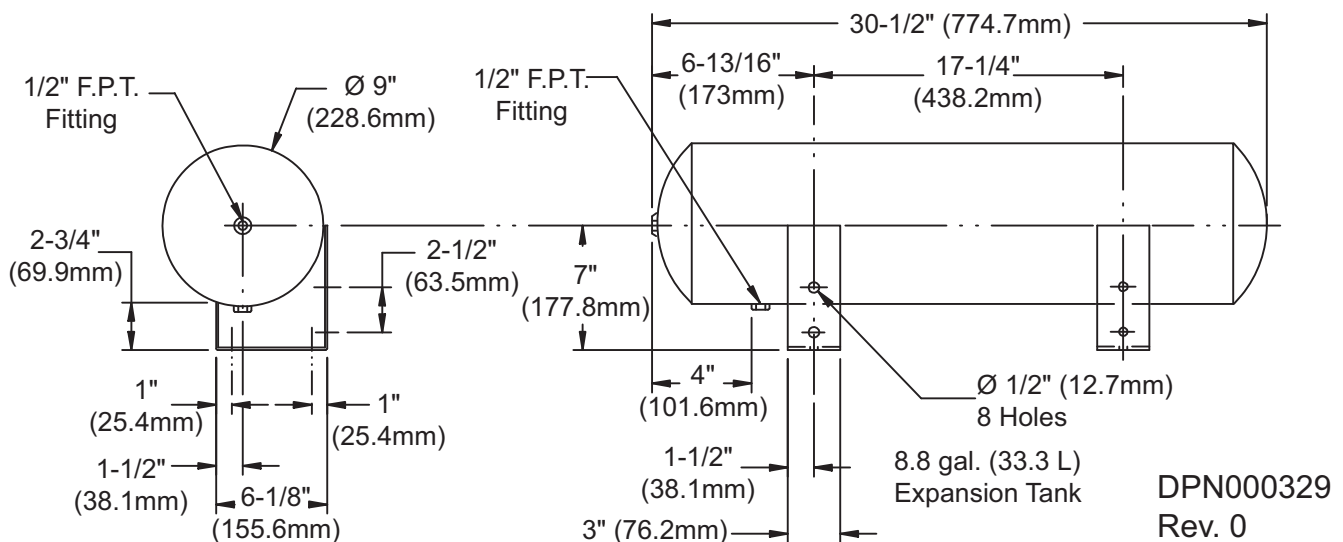


Table 41 Pump data

Pump Model	Connections		HP	Electric @ 60Hz				
	NPT Suction	Female Discharge		PH	208 FLA	230 FLA	460 FLA	575 FLA
3/4	1-1/4"	3/4"	3/4	1	7.6	6.9	N/A	N/A
3/4	1-1/4"	3/4"	3/4	3	3.5	3.2	1.6	1.3
1-1/2	1-1/4"	3/4"	1-1/2	3	6.6	6.0	3.0	2.4
2	1-1/4"	3/4"	2	3	7.5	6.8	3.4	2.7
3	1-1/2"	1"	3	3	10.6	9.6	4.8	3.9
5	1-1/2"	1-1/4"	5	3	16.7	15.2	7.6	6.1
7-1/2	3"	3"	7-1/2	3	24.2	22.0	11.0	9.0

To calculate total pump and drycooler Full Load Amps (FLA):

Total FLA = Pump FLA + Drycooler FLA

To Calculate total pump and drycooler Wire Size Amps (WSA)

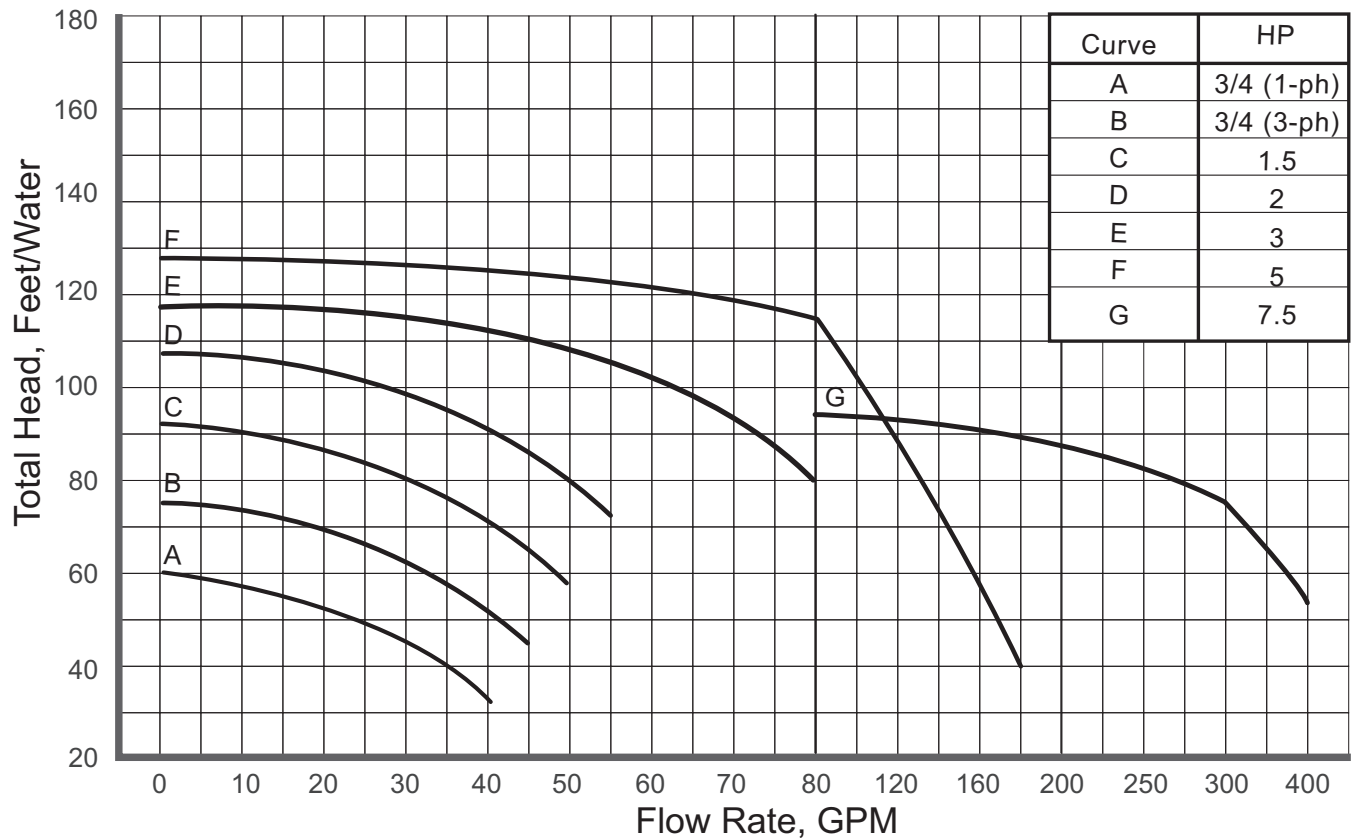
Total WSA = Largest Motor FLA x 1.25 + Sum of other Motor FLA values

To Calculate Total Pump and Drycooler Maximum Overcurrent Protective Device (OPD)

Total OPD = Largest Motor FLA x 4.0 + Sum of other Motor FLA values

Select standard fuse size (15A, 20A, 25A, 30A, etc.)

Source DPN000329, Rev. 0

Figure 50 Pump curve, 60Hz

6.4 Liebert Glycol-Cooled Direct Drive Drycoolers

6.4.1 Standard Features

Source: DPN000273, Revision 1

Coil—Emerson®-manufactured coil is constructed of copper tubes in a staggered tube pattern. Tubes are expanded into continuous, rippled aluminum type fins. The fins have full depth fin collars completely covering the copper tubes which are connected to heavy wall Type “L” headers. Inlet coil connector tubes pass through relieved holes in the tube sheet for maximum resistance to piping strain and vibration. Coils are factory leak tested at a minimum of 300 PSIG, dehydrated, then filled and sealed with a nitrogen holding charge for shipment.

Fan(s)—Blades are constructed of zinc-plated steel or aluminum with a diameter of 26 inches (660.4mm) and secured to the fan shaft by a heavy duty hub with set screw. Fan guards are heavy gauge, close meshed, steel wire with corrosion resistant finish. Fans are factory-balanced and tested before shipment.

Fan Motor(s)—Provided with rain slingers, permanently lubricated bearings and individual built-in overload protection. Motors are rigidly mounted on die-formed galvanized steel supports.

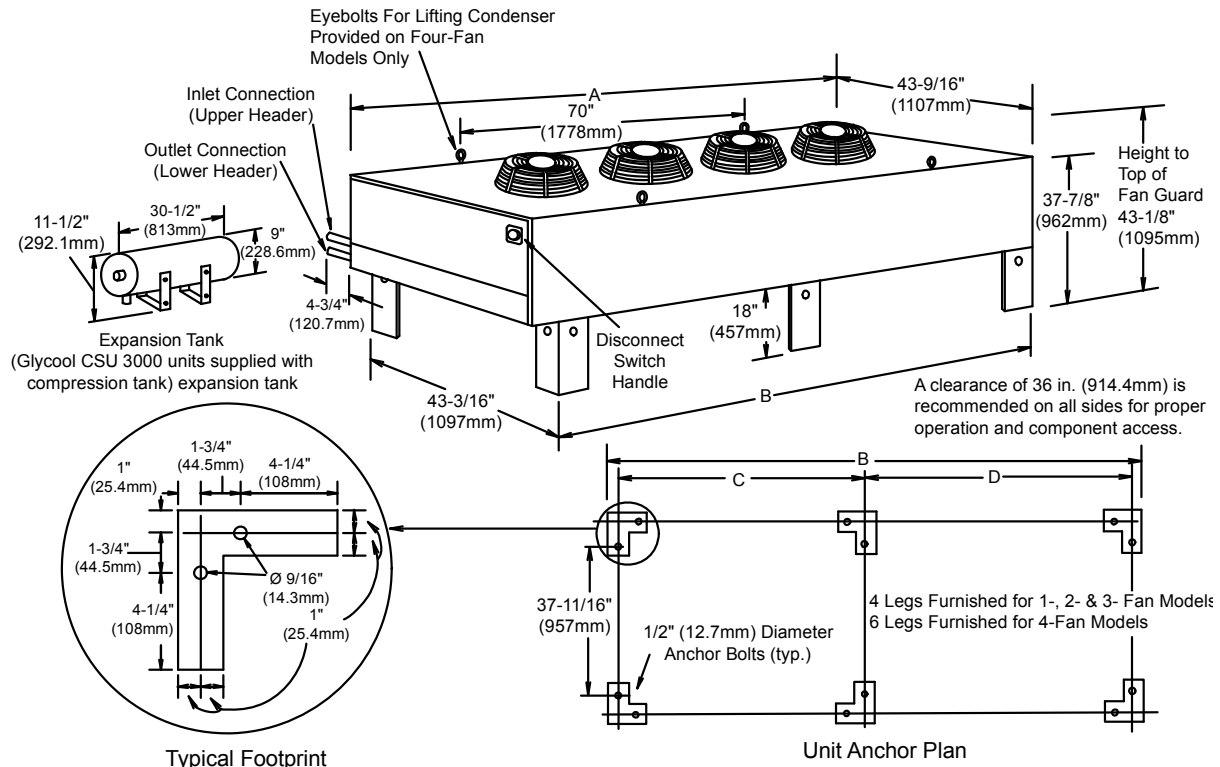
Housing—The drycooler housing is constructed of bright aluminum sheet and divided into individual fan sections by full width baffles. Structural support members, including coil support frame, motor, and drive support, are galvanized steel for strength and corrosion resistance. Aluminum legs are provided with rigging holes for hoisting the unit into position.

Fluid Temperature Control System (Fan Cycling)—Complete with aquastats and electrical control circuit factory-wired in the integral control panel. Aquastats cycle fans to maintain fluid temperature as outdoor air temperature changes. Head pressure is controlled by the fluid regulating valve in the Liebert indoor unit.

Unit Disconnect Switch—A locking disconnect factory-installed and wired in enclosed control section (standard with DSO, DDO drycoolers).

Pump Controls—Factory-wired in the integral control panel. Single power feed to drycooler supplies power to both drycooler and pumps (electric service connection). Single pump (DSO) and dual pump (DDO) control options are available.

DDO—Drycooler keeps one pump in active mode and the other in standby mode. Switchover between pumps activated by factory-supplied pump selector switch or by contact closure on field-installed flow switch.

Figure 51 Cabinet and anchor dimensions for direct drive drycoolers

1. All drycooler fan motors are 3/4hp.
2. DSO model prefix indicates that the control section in the drycooler includes controls for a single pump package.
DDO model prefix indicates that the control section in the drycooler includes controls for a dual pump package.
DSF model prefix indicates that the control section in the drycooler includes controls for a single pump package on a fan speed control drycooler.
3. DNT prefix indicates a single circuit with fan cycling but no pump controls.
4. DNC prefix indicates a single circuit with no fan or pump controls.

DPN000274
Rev. 1

Model # Note 2, 3, 4	# of Fans	A in (mm)	B in (mm)	C in (mm)	D in (mm)	CFM (l/s) 60Hz Note 1	CFM (l/s) 50Hz Note 1	Internal Volume gal. (L)	Net Weight lb. (kg)
-112	1	51-1/2 (1308)	44 (1118)	42 (1067)	—	6088 (2873)	5074 (2394)	5.8 (22.0)	470 (213)
-174	2	91-1/2 (2324)	84 (2134)	82 (2083)	—	13265 (6261)	11054 (5217)	6.9 (26.2)	605 (274)
-197	2	91-1/2 (2324)	84 (2134)	82 (2083)	—	12645 (5968)	10535 (4973)	9 (34)	645 (293)
-225	2	91-1/2 (2324)	84 (2134)	82 (2083)	—	12177 (5748)	10147 (4789)	11.1 (42.1)	685 (310)
-310	3	131-1/2 (3340)	124 (3150)	122 (3099)	—	18965 (8951)	15804 (7459)	13.1 (49.6)	886 (402)
-419	4	171-1/2 (4356)	164 (4166)	82 (2083)	80 (2032)	23650 (11163)	19708 (9302)	17.4 (65.9)	1120 (508)

Source DPN000274, Rev. 1

Table 42 Piping, direct drive drycoolers, O.D., Cu

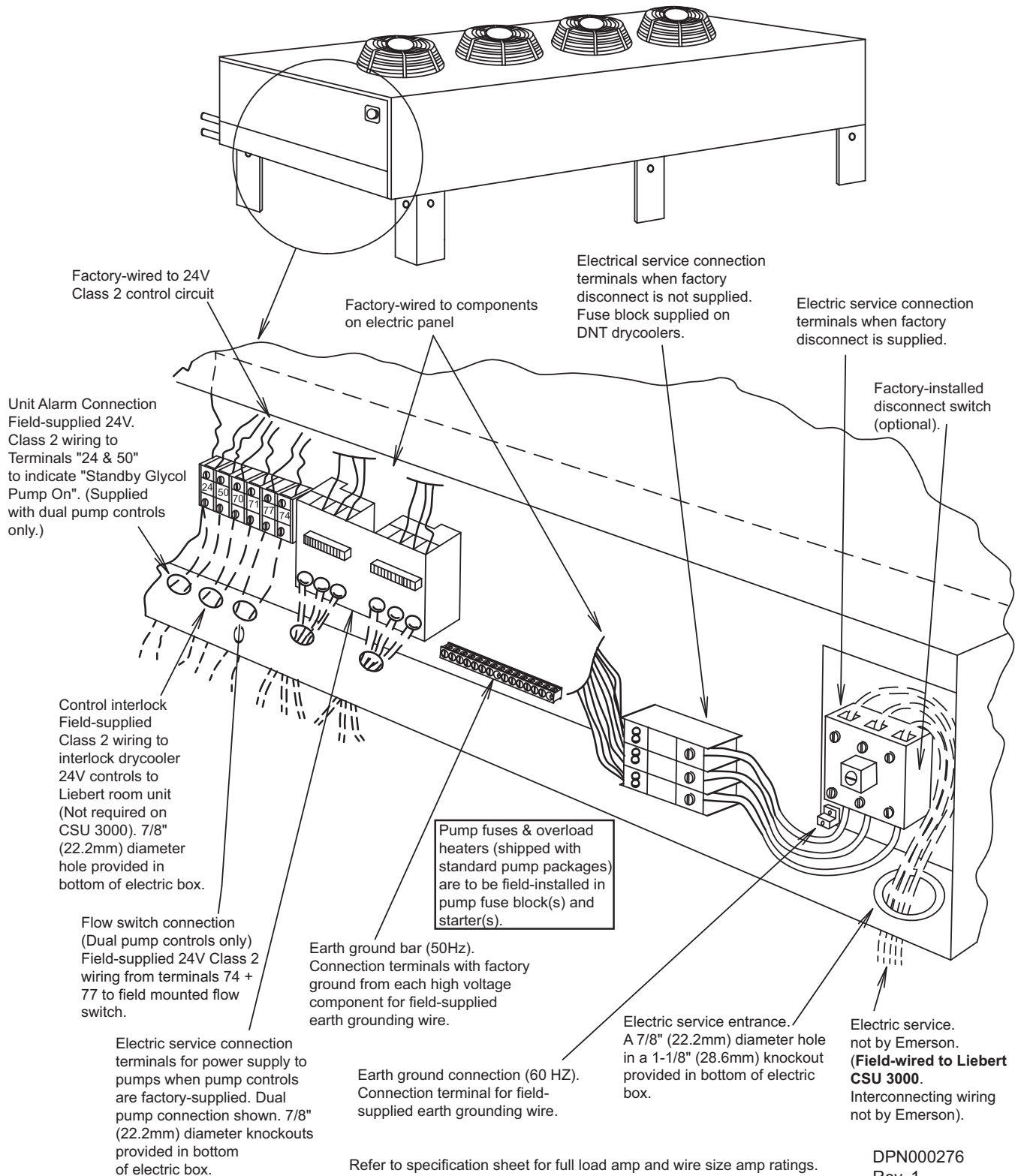
Drycooler Model #	Number of Coil Circuits	Inlet & Outlet Pipe Diameter (Inches)
-112	8	1-3/8
-112	16*, 26	2-1/8
-174	8, 16*, 24	2-1/8
-197	8	1-3/8
-197	16*, 32	2-1/8
-225	16, 26*	2-1/8
-310	16, 32*	2-1/8
-419	16, 32*	2-1/8

* Standard Circuiting

- For model prefix designation, refer to **Figure 51**.

Source: DPN000274, Rev. 1

Figure 52 Fluid temperature control direct drive drycoolers



7.0 CHILLED WATER SYSTEMS—600MM (24IN.) AND 300MM (12IN.) CABINETS

7.1 Performance Data—600mm (24in.) Units

Table 43 Capacities, chilled water models, CR040RC

	45°F (7.2°C) EWT 10°F (5.6°C) Water Rise	50°F (10°C) EWT 10°F (5.6°C) Water Rise
105°F DB, 71°F WB (40.6°C DB, 21.6°C WB) 17% RH		
Total kBTU/H (kW)	192.1 (56.3)	163.9 (48)
Sensible BTU/H (kW)	177 (51.9)	163.5 (47.9)
Flow Rate, GPM (l/s)	39.1 (2.5)	33.6 (2.1)
Pressure Drop, ft. H ₂ O (kPa)	55.2 (164.8)	41 (122.5)
100°F DB, 69.5°F WB (37.8°C DB, 20.8°C WB) 20% RH		
Total kBTU/H (kW)	176.4 (51.7)	148.5 (43.5)
Sensible BTU/H (kW)	161.9 (47.4)	148.3 (43.5)
Flow Rate, GPM (l/s)	36 (2.3)	30.5 (1.9)
Pressure Drop, ft. H ₂ O (kPa)	47.4 (141.6)	34.4 (102.7)
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB) 23% RH		
Total kBTU/H (kW)	159.9 (46.9)	132.8 (38.9)
Sensible BTU/H (kW)	146.4 (42.9)	132.8 (38.9)
Flow Rate, GPM (l/s)	32.7 (2.1)	27.3 (1.7)
Pressure Drop, ft. H ₂ O (kPa)	39.8 (118.9)	28.2 (84.3)
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB) 27% RH		
Total kBTU/H (kW)	142.6 (41.8)	116.9 (34.3)
Sensible BTU/H (kW)	130.8 (38.3)	116.9 (34.3)
Flow Rate, GPM (l/s)	29.3 (1.8)	24.2 (1.5)
Pressure Drop, ft. H ₂ O (kPa)	32.5 (97)	22.5 (67.4)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB) 31% RH		
Total kBTU/H (kW)	125.4 (36.7)	100.7 (29.5)
Sensible BTU/H (kW)	114.7 (33.6)	100.7 (29.5)
Flow Rate, GPM (l/s)	25.8 (1.6)	20.9 (1.3)
Pressure Drop, ft. H ₂ O (kPa)	25.9 (77.3)	17.4 (51.9)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH		
Total kBTU/H (kW)	108.2 (31.7)	83.9 (24.6)
Sensible BTU/H (kW)	98.2 (28.8)	83.9 (24.6)
Flow Rate, GPM (l/s)	22.4 (1.4)	17.6 (1.1)
Pressure Drop, ft. H ₂ O (kPa)	20 (59.8)	12.7 (37.9)

The net capacity data has fan motor heat factored in for all ratings.

Capacity data is factory-certified to be within 5% tolerance.

Data rated with standard filter.

7.2 Performance Data—300mm (12in.) Units

Table 44 Capacities, chilled water models, CR032RC1

	45°F (7.2°C) EWT 10°F (5.6°C) Water Rise	50°F (10°C) EWT 10°F (5.6°C) Water Rise
95°F DB, 67.9°F WB (35°C DB, 19.9°C WB) 23% RH		
Total kBTU/H (kW)	100.9 (29.6)	88.7 (26)
Sensible kBTU/H (kW)	97.7 (28.6)	86.0 (25.2)
Flow Rate, GPM (l/s)	18.8 (1.2)	18.2 (1.1)
Pressure Drop, ft H ₂ O (kPa)	27.9 (83.3)	26 (77.6)
90°F DB, 66.2°F WB (32.2°C DB, 19.0°C WB) 27% RH		
Total BTU/H (kW)	89.1 (26.1)	72.3 (21.2)
Sensible BTU/H (kW)	85.9 (25.2)	71.6 (21)
Flow Rate, GPM (l/s)	18 (1.1)	13.9 (0.9)
Pressure Drop, ft H ₂ O (kPa)	25.2 (75.3)	15.4 (45.9)
85°F DB, 64.5°F WB (29.4°C DB, 18.1°C WB) 31% RH		
Total BTU/H (kW)	75.7 (22.2)	61.6 (18)
Sensible BTU/H (kW)	73.6 (21.6)	58.9 (17.3)
Flow Rate, GPM (l/s)	15.4 (1)	11.4 (0.7)
Pressure Drop, ft H ₂ O (kPa)	18.4 (55.1)	9.8 (29.3)
80°F DB, 62.8°F WB (26.7°C DB, 17.1°C WB) 37% RH		
Total BTU/H (kW)	63.0 (18.5)	50.0 (14.6)
Sensible BTU/H (kW)	61.6 (18.1)	48.5 (14.2)
Flow Rate, GPM (l/s)	11.9 (0.8)	10.3 (0.7)
Pressure Drop, ft H ₂ O (kPa)	4.3 (12.8)	8.2 (24.4)

7.3 Physical Data—600mm (24in.) Units

Table 45 Physical data—Chilled water, 600mm (24in.) wide models

	40kW Models
Fan Data	
Total Airflow, CFM (m ³ /h)	3325 (5650)
Total Fan Motor, hp (kW)	1.7 (1.26)
Number of Fans	2
Evaporator Coil	
Face Area, ft ² (m ²)	7.26 (0.674)
Rows	6
Face Velocity, FPM (m/s)	459.0 (2.33)
Electric Reheat Single Stage	
Capacity, BTU/H (kW)	460V: 20,472 (6.0) 208V: 16,719 (4.9)
Steam Generating Humidifier	
Capacity, lb/hr (kg/hr)	5.0 (2.3)
Capacity, kW	1.79
Condensate Pump - Dual Float Type	
Capacity, GPM (l/m)	6.0 (22.7)
Filter Section - Disposable Type; MERV 8 - Standard Pleated Filter	
Quantity	2
Nominal Size, in (mm)	31-1/2 x 17-1/2 x 4 (800 x 445 x 100)
Effective Surface Area - ft ² (m ²)	16.4 (1.52)
MERV 11 - Optional Pleated Filter	
Quantity	2
Nominal Size, in (mm)	31-1/2 x 17-1/2 x 4 (800 x 445 x 100)
Effective Surface Area - ft ² (m ²)	16.4 (1.52)
Motorized Ball Valve	
Maximum Allowable Pressure, psi (kPa)	325 (2241)
Maximum Close-Off Pressure, psi (kPa)	200 (1379)
Maximum Differential Pressure (Full Flow), psi (kPa)	50 (345)

7.4 Physical Data—300mm (12in.) Units

Table 46 Physical data—Chilled water, 200mm (12in.) wide models

Model	CR032RC1
Fan Data	
Total Airflow, CFM(m ³ /h)	2550 (4332)
Total Fan Motor hp (kW)	1.3 (0.98)
Number of Fans	6
Evaporator	
Face Area, ft ² (m ²)	7.75 (0.72)
Rows	3
Face Velocity	329 (1.67)
Condensate Pump-Dual Float:	
Capacity, GPM (l/m)	208V condensate pump rated for 0.77GPM at 13 ft. (2.8 l/m at 3.9m) of total head pressure 230V condensate pump rated for 0.90 GPM at 13 ft. (3.4 l/m at 3.9m) of total head pressure 266V condensate pump rated for 0.81 GPM at 13 ft. (3.1 l/m at 3.9 m) of total head pressure 115V condensate pump rated for 0.96 GPM at 13 ft. (3.6 l/m at 3.9 m) of total head pressure
Filter Section	
Washable MERV1	
Quantity	2
Nominal Size, in (mm)	36 X 10 X0.4 (914 X 254 X 10)
Effective Surface Area, ft ² (m ²)	2.4 (0.22)
2" MERV8	
Quantity	2
Nominal Size, in (mm)	36 X 10 X2 (914 X 254 X 51)
Effective Surface Area, ft ² (m ²)	5.8 (0.54)
Motorized Ball Valve	
Maximum Allowable Pressure, PSI (kPa)	325 (2241)
Maximum Close-off Pressure, PSI (kPa)	200 (1379)
Maximum Differential Pressure (Full Flow), PSI (kPa)	50 (345)

7.5 Operating Limits for Chilled Water Units

Table 47 Operating limits—Chilled water, 600mm (24in.) and 300mm (12in.) wide models

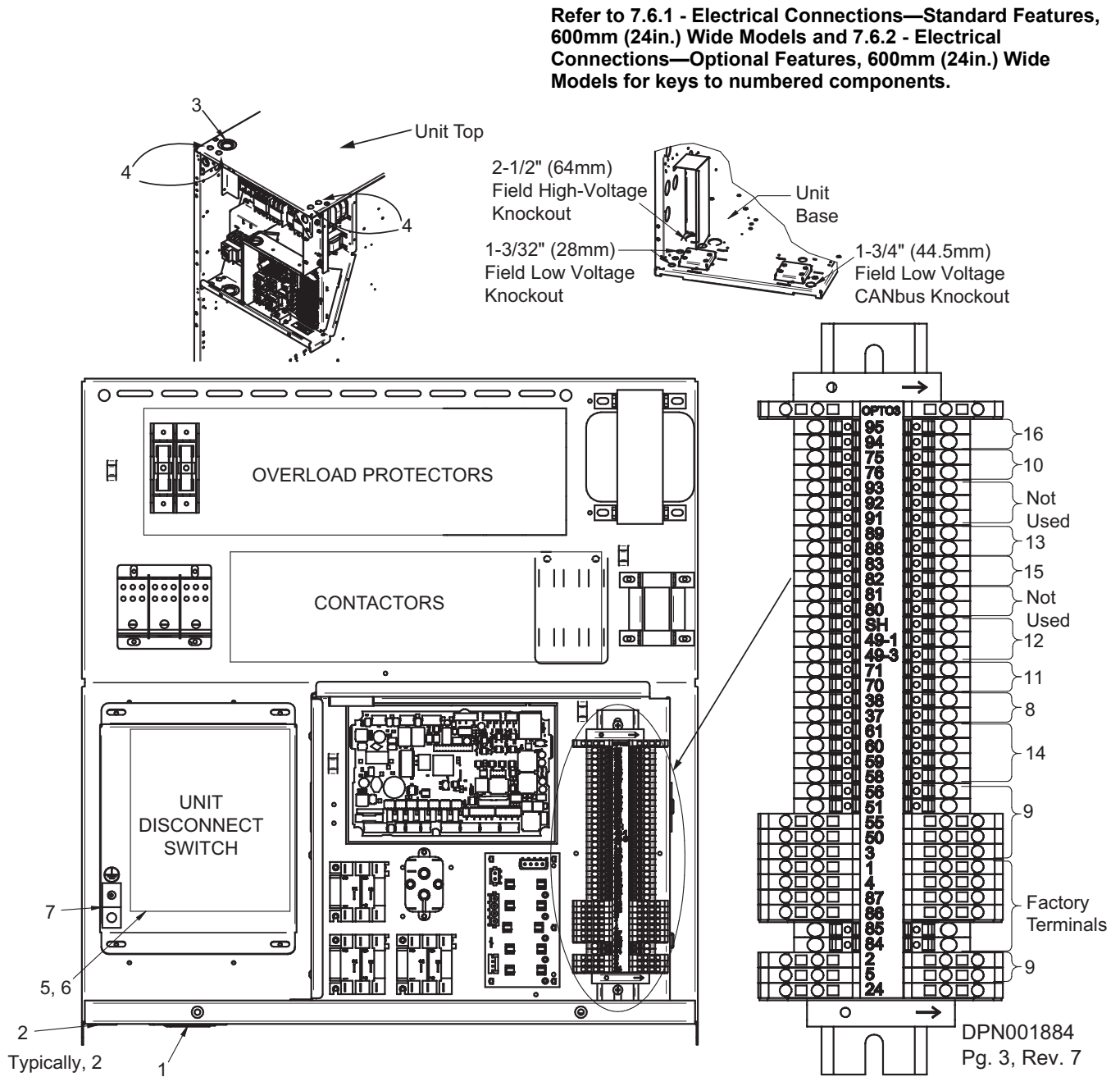
Models	Maximum Water Pressure, psi (kPa)	Maximum Close-Off Pressure, psi (kPa)	Minimum Entering Water Temperature, °F (°C)
			Design Condition
CR040RC CR032	325 (2241)	200 (1379)	45 (7.2)

7.6 Electrical Data—600mm (24in.) Units

Table 48 Electrical data—Chilled water, 600mm (24in.) wide models

Voltage	CR040RC	
	460/3/60	208/3/60
Dehumidification, With or Without Humidifier, Reheat, Condensate Pump		
FLA	12.2	24.9
WSA	15.3	31.1
OPD	15	35
Dehumidification, Condensate Pump and Humidifier; NO Reheat		
FLA	8.4	16.7
WSA	10.5	20.9
OPD	15	25
Dehumidification and Condensate Pump; NO Reheat, NO Humidifier		
FLA	4.7	8.3
WSA	5.1	9.1
OPD	15	15
Dehumidification and Reheat; NO Condensate Pump, NO Humidifier		
FLA	11.0	22.6
WSA	13.8	28.3
OPD	15	30
Dehumidification; NO Condensate Pump, NO Reheat, NO Humidifier		
FLA	3.5	6.0
WSA	3.9	6.8
OPD	15	15

Figure 53 Electrical field-connection locations



7.6.1 Electrical Connections—Standard Features, 600mm (24in.) Wide Models

Source: DPN001884, Rev. 7, Pg. 1

1. **High-Voltage Connection Through the Bottom of the Electric Panel**—1-3/8" (34.9mm), 1-3/4" (44.5mm) and 2-1/2" (64mm) diameter concentric knockout.
2. **Low-Voltage Connection Through the Bottom of the Electric Panel**—Two knockouts, each 7/8" (22mm) diameter.
3. **High-Voltage Connection Through the Top of the Unit**—1-3/8" (34.9mm), 1-3/4" (44.5mm) and 2-1/2" (64mm) diameter concentric knockout.
4. **Low-Voltage Connection Through the Top of the Unit**—Four knockouts, each 7/8" (22mm) diameter.
5. **Three-Phase Electrical Service**—Connect to terminals on disconnect switch. Three-phase service not by Emerson. Refer to **7.6.3 - Important Note for 460V-Rated Liebert CRV Units (CR*****A)**.
6. **Factory-Installed Locking Disconnect Switch**
7. **Earth Ground**—Terminal for field-supplied earth grounding wire.
8. **Remote Unit Shutdown**—Replace existing jumper between Terminals 37 and 38 with field-supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field-supplied Class 1 wiring.
9. **Customer Alarm Inputs**—Terminals for field-supplied, normally closed contacts having a minimum 75VA, 24VAC rating, between Terminals 3 and 50, Terminals 2 and 51, Terminals 5 and 55 or Terminals 3 and 56. Use field-supplied Class 1 wiring. Terminal 3 and 56 are used for humidifier alarm when a humidifier is installed. The remaining terminals are available for customer alarm inputs, such as smoke sensors and building fire alarms.
10. **Common Alarm**—On any alarm, normally open dry contact is closed across Terminals 75 and 76 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
11. **Heat Rejection Interlock**—On any call for compressor operation, normally open dry contact is closed across Terminals 70 and 71 to heat rejection equipment. 1A, 24VAC maximum load. Use field-supplied, Class 1 wiring.
12. **CANbus Connector**—Terminal block with Terminals 49-1 (CAN-H) and 49-3 (CAN-L) + SH (shield connection). The terminals are used to connect the CANbus communication cable (provided by others) from the indoor unit to the Liebert MC, Premium model.

CANbus Cable—CANbus cable provided by others to connect to the outdoor condenser. No special considerations are required when the total external cable connection between the indoor unit and outdoor unit(s) is less than 450 ft. (137m). For total external cable connections greater than 450 ft. (137m) but less than 800 ft. (243m), a CANbus isolator is required. Cable must have the following specifications:

- Conductors: 22-18AWG stranded tinned copper
- Twisted Pair (minimum four twists per foot [305mm])
- Braided shield or foil shield with drain wire
- Low Capacitance: 15pF/ft or less
- UL-approved temperature rated to 167°F (75°C)
- UL-approved voltage rated to 300V
- UV-resistant and moisture-resistant if not provided in conduit
- Plenum rated: NEC type CMP (if required by national or local codes)

Examples: Belden 89207 (plenum rated), or Alpha Wire 6454 Category 5, 5e or higher

7.6.2 Electrical Connections—Optional Features, 600mm (24in.) Wide Models

Source: DPN001884, Rev. 7, Pg. 2

13. **Condensate Pump High Water Alarm** (available when optional pump is installed)—On pump high-water indication, normally open dry contact is closed across Terminals 88 and 89 for remote indication. 1A, 24VAC maximum load. Use field-supplied, Class 1 wiring.
14. **Liebert Liqui-tect® Shutdown and Dry Contact** (available when optional Liebert Liqui-tect sensor is installed)—On Liebert Liqui-tect activation, normally open dry contact is closed across Terminals 58 and 59 for remote indication. The Liebert Liqui-tect sensor notifies the Liebert iCOM® of indication through Terminals 60 and 61. 1A, 24VAC maximum load. Use Class 1, field-supplied wiring.
15. **Reheat and Humidifier Lockout**—Remote 24VAC required at Terminals 82 and 83 for lockout of reheat and humidifier.
16. **Additional Common Alarm**—On any alarm, one additional normally open dry contact is closed across Terminals 94 and 95 for remote indication. 1A, 24VAC maximum load. Use Class 1, field-supplied wiring.



NOTE

Refer to specification sheet for total unit full load amps, wire size amps and maximum overcurrent protective device size.

7.6.3 Important Note for 460V-Rated Liebert CRV Units (CR*****A)

Source: DPN001884, Rev. 7, Pg. 2

NOTICE

Risk of improper input power. Can cause equipment damage.

The electronically commutated motors included in the Liebert CRV are suitable for connection to an electrical service providing input power to the unit with 300V or less line-to-ground potential only.

Acceptable Unit Input Electrical Service for 460V (480V) Nominal Units

- 480V wye with solidly grounded neutral and 277V line-to-ground

Unacceptable Unit Input Electrical Service for 460v (480v) Nominal Units

- Wye with high-resistance (or impedance) ground
- Delta without ground or with floating ground
- Delta with corner ground
- Delta with grounded center tap

7.7 Electrical Data—300mm (12in.) Units

Table 49 Electrical data—Chilled water, 300mm (12in.) wide models

Voltage	FLA	WSA	OPD
With Condensate Pump			
120V/1Ph/60Hz	14.6	15.2	20
208-230V/1Ph/60Hz	12.3	12.8	15
208-230V/3Ph/60Hz	7.5	8.3	15
460V/3Ph/60Hz (Wye Connected)	4.3	4.8	15
Without Condensate Pump			
120V/1Ph/60Hz	13.2	13.8	15
208-230V/1Ph/60Hz	11.4	11.9	15
208-230V/3Ph/60Hz	6.6	7.4	15
460V/3Ph/60Hz (Wye Connected)	3.8	4.3	15

7.7.1 Standard Electrical Field Connections—300mm (12in.) Air-Cooled and Chilled Water Models

Source: DPN002810, Rev. 5, Pg. 1

1. **High-Voltage Connection Through the Rear of the Disconnect Switch Box**—1-1/8" (28.6mm) and 1-3/4" (44.5mm) diameter concentric knockout.
2. **High-Voltage Connection Through the Top of the Unit**—1-1/4" (32mm) and 1-3/4" (44mm) diameter concentric knockout.
3. **Electrical Service** (hard wired)—Refer to serial tag for unit electrical service requirements.
 - **Three Phase:** 208/230V 60Hz
 - **Three Phase with Neutral:** 460V 60Hz wye (5 wire: 3 phase + neutral + ground).
 - **Single Phase:** 208/230V 60Hz (chilled water only).

Connect to terminals on disconnect switch. Electrical service not by Emerson. Use copper conductors only.

Wire per local codes. Refer to specification sheet for total unit full load amps, wire size amps and maximum overcurrent protective device size.
4. **Electrical Service** (cord connected)—Refer to serial tag for unit electrical service requirements. **Single Phase**—120V 60Hz (chilled water only). 1-3/4" (44mm) diameter knockout provided in the top and bottom of the unit for the power cord to exit the unit. The power cord is factory-supplied with an L5-20 plug.
5. **Factory-Installed Locking Disconnect Switch**
6. **Earth ground**—Terminal for field-supplied earth grounding wire.
7. **Low-Voltage Connection Through the Bottom of the Unit**—Two knockouts, each 7/8" (22mm) diameter, not shown.
8. **Low-Voltage Connection Through the Top of the Unit**—Two knockouts, each 7/8" (22mm) diameter.
9. **Remote Unit Shutdown**—Replace existing jumper between Terminals 37 and 38 with field-supplied normally closed switch having a minimum 75VA, 24VAC rating. Use field-supplied Class 1 wiring.
10. **Customer Alarm Inputs**—Terminals for field supplied, normally closed contacts, having a minimum 75VA, 24VAC rating, between Terminals 3 and 50, Terminals 2 and 51, Terminals 5 and 55 or Terminals 3 and 56. Use field-supplied Class 1 wiring. Terminals 5 and 55 not available when optional condensate pump is installed.
11. **Common Alarm**—On any alarm, normally open dry contact is closed across Terminals 75 and 76 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
12. **Heat Rejection Interlock**—On any call for compressor operation, normally open dry contact is closed across Terminals 70 and 71 to heat rejection equipment. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
13. **CANbus Connector**—Terminal block with Terminals 49-1 (CAN-H) and 49-3 (CAN-L) + SH (shield connection). The terminals are used to connect the CANbus communication cable (field-supplied) from the indoor unit to the Liebert MC Condenser, Premium Model.

CANbus Cable—CANbus cable provided by others to connect to the outdoor condenser. No special considerations are required when the total external cable connection between the indoor unit and outdoor unit(s) is less than 450 ft. (137m). A CANbus isolator is required for total external cable connections greater than 450 ft. (137m) but less than 800 ft. (243m). Cable must meet the following specifications:

 - Conductors—22-18AWG stranded, tinned copper
 - Twisted pair (minimum four twists per foot [305mm])
 - Braided shield or foil shield with drain wire
 - Low capacitance—15pF/ft or less
 - UL-approved temperature rated to 167°F (75°C)
 - UL-approved voltage rated to 300V
 - UV-resistant and moisture-resistant if not run in conduit
 - Plenum rated: NEC type CMP (if required by national or local codes)

Examples: Belden 89207 (plenum rated), or Alpha Wire 6454, Category 5, 5e or higher

7.7.2 Electrical Field Connections for Optional Features—300mm (12in.) Air-Cooled and Chilled Water Models

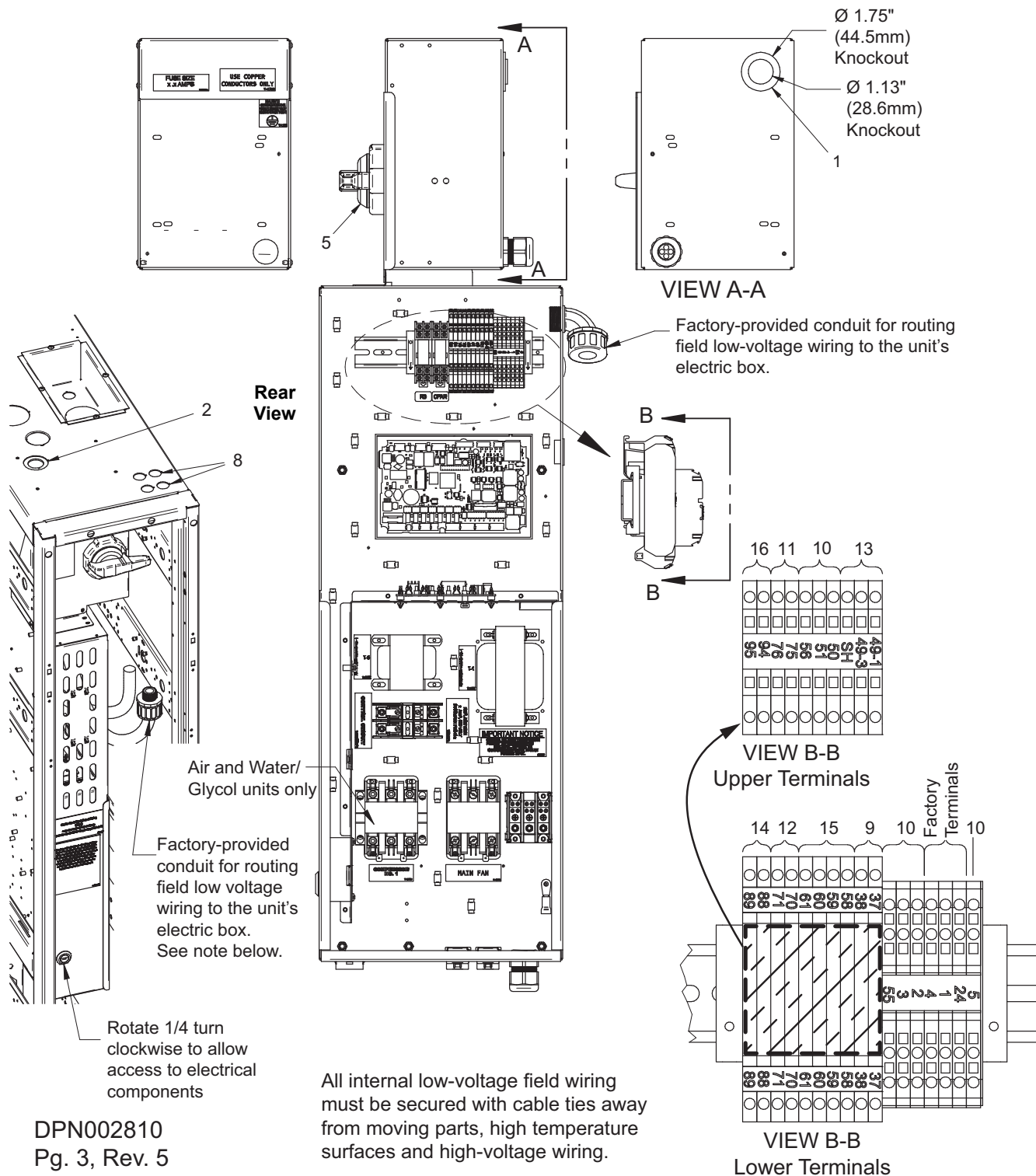
Source: DPN002810, Rev. 5, Pg. 2

14. **Condensate Pump High Water Alarm** (available when optional pump is installed)—On pump high water indication, normally open dry contact is closed across Terminals 88 and 89 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
15. **Liebert Liqui-tect® Shutdown and Dry Contact** (available when optional Liebert Liqui-tect sensor is installed)—On Liebert Liqui-tect activation, normally open dry contact is closed across Terminals 58 and 59 for remote indication. The Liebert Liqui-tect sensor notifies Liebert iCOM® of indication through Terminals 60 and 61. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.
16. **Additional Common Alarm**—On any alarm, one additional normally open dry contact is closed across Terminals 94 and 95 for remote indication. 1A, 24VAC maximum load. Use field-supplied Class 1 wiring.

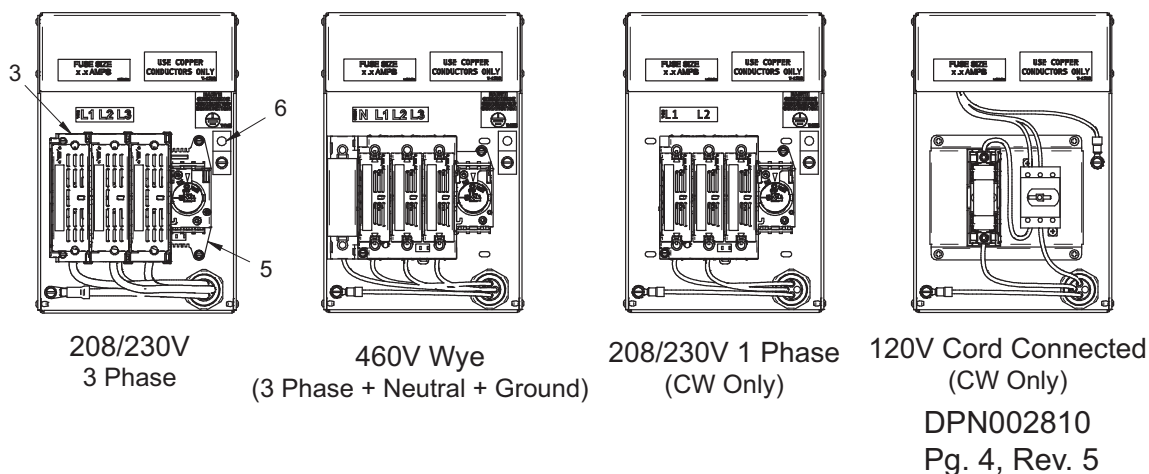
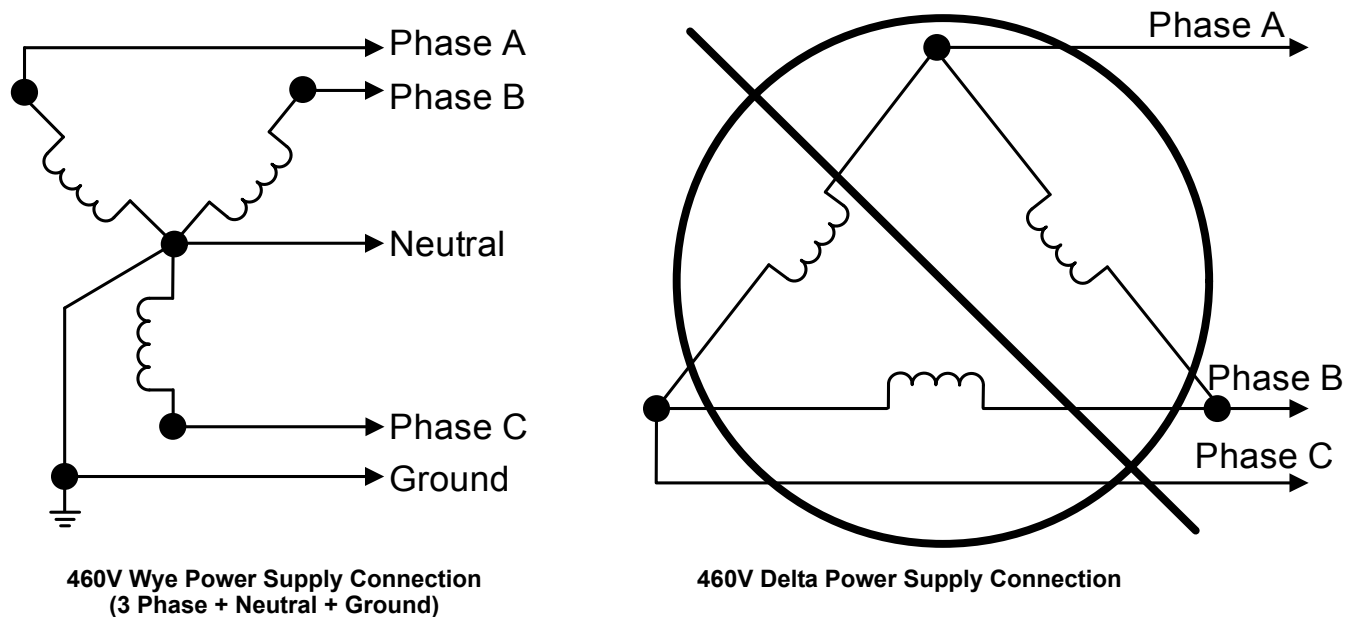
Figure 54 Electrical field connections—300mm (12in.) air-cooled and chilled water models

Refer to 3.6 - Electrical Field Connections—Standard Features, 300mm (12in.) DX Models and 3.6.1 - Electrical Field Connections—Optional Features, 300mm (12in.) DX Models for keys to numbered components.

See Figure 10 for low-voltage field wiring routing into the unit



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Figure 55 Electrical field connections—Disconnect views**Figure 56 Power supply requirements for 300mm (12") wide, 460V Liebert CRV models**

NOTICE

Risk of improper input power. Can cause equipment damage.

The 460V Liebert CRV 300mm (12in.) unit is designed to operate with wye-connected power with a solidly grounded neutral. It will not operate properly with wye-connected power with high-resistance (or impedance) ground or with delta-connected power.

Acceptable Power Supplies—480V Nominal Units

- 480V wye with solidly grounded neutral and 277V line-to-neutral

Unacceptable Power Supplies—480V Nominal Units

- Wye with high-resistance (or impedance) ground
- Delta without ground or with floating ground
- Delta with corner ground
- Delta with grounded center tap

Figure 57 Electrical field connections 460V 300mm (12in.) chilled water unit

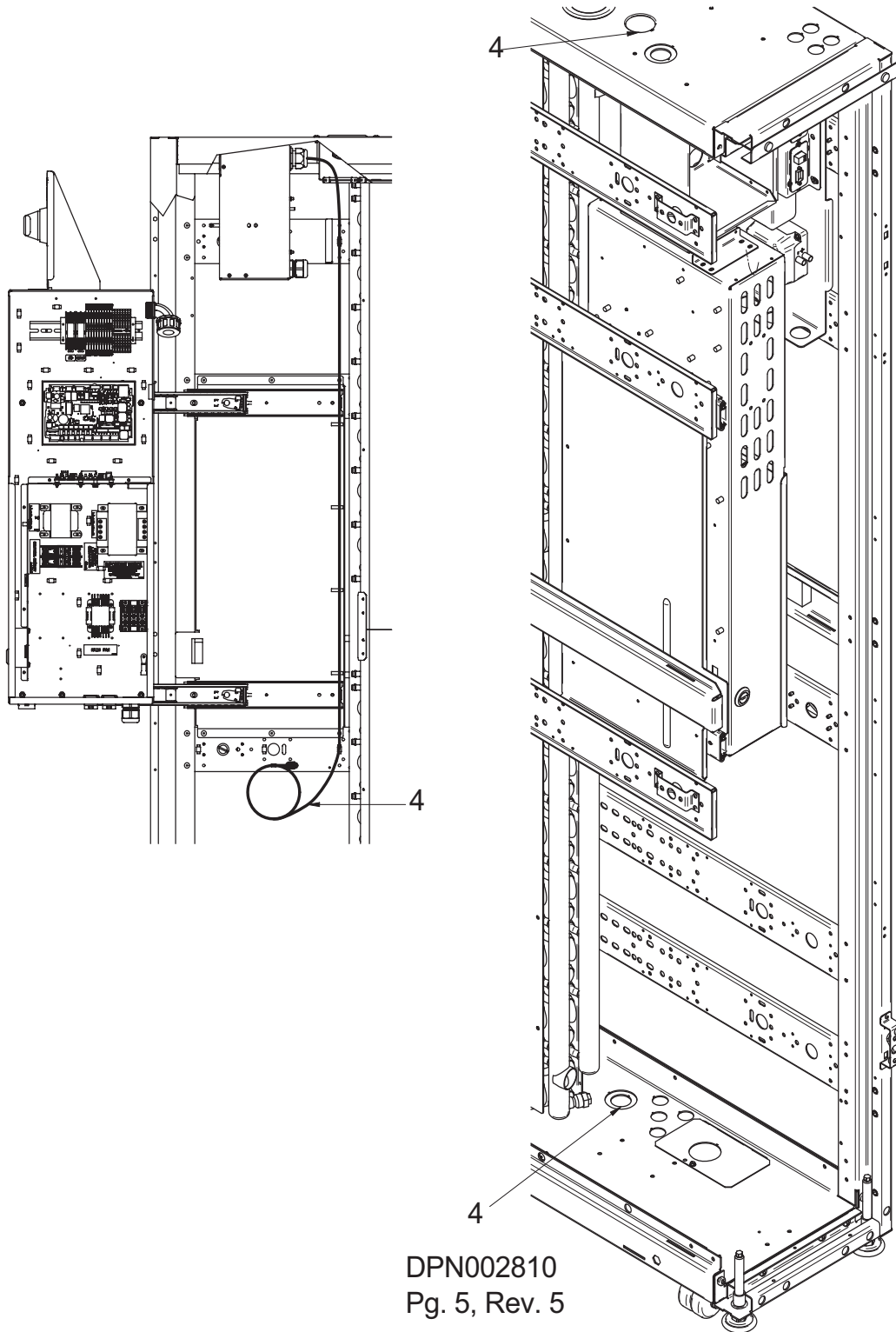


Figure 58 Power cable routing—Bottom entry, 300mm (12") chilled water models

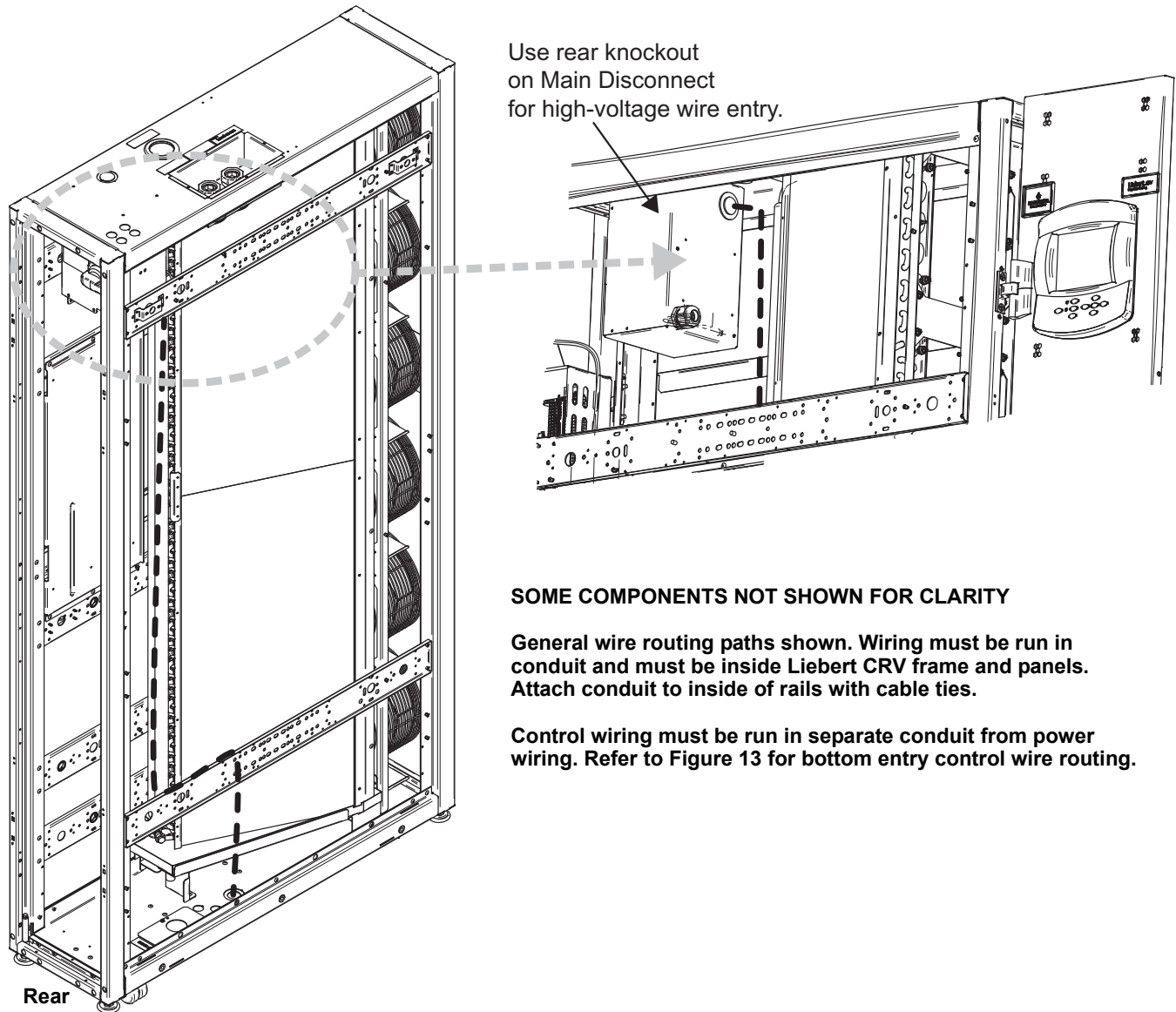
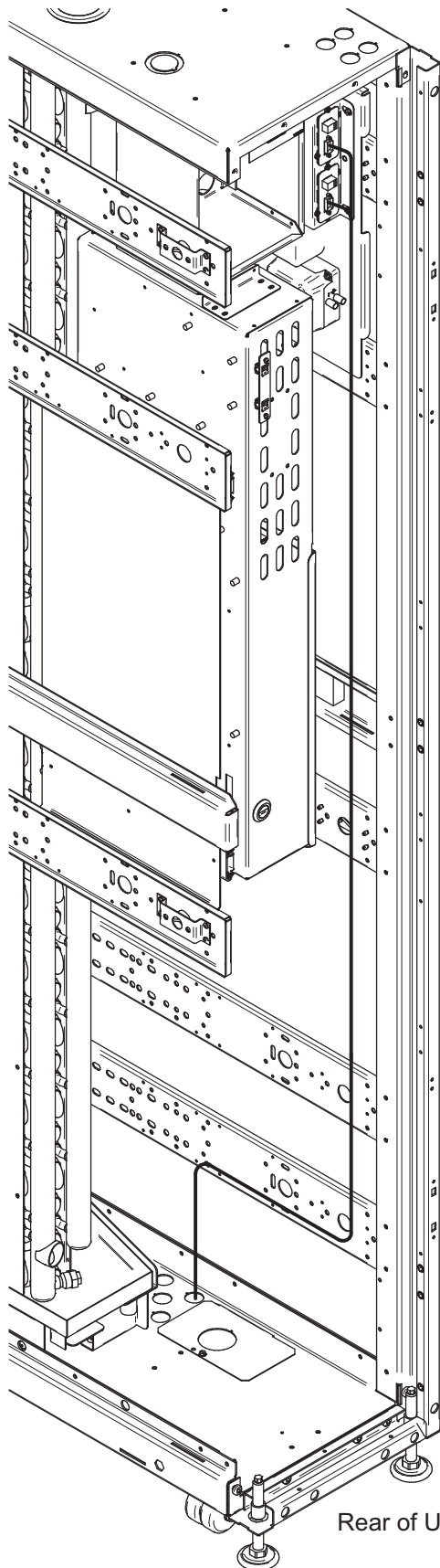


Figure 59 Liebert IntelliSlot™ cable routing—Bottom entry, 300mm (12in.) chilled water models

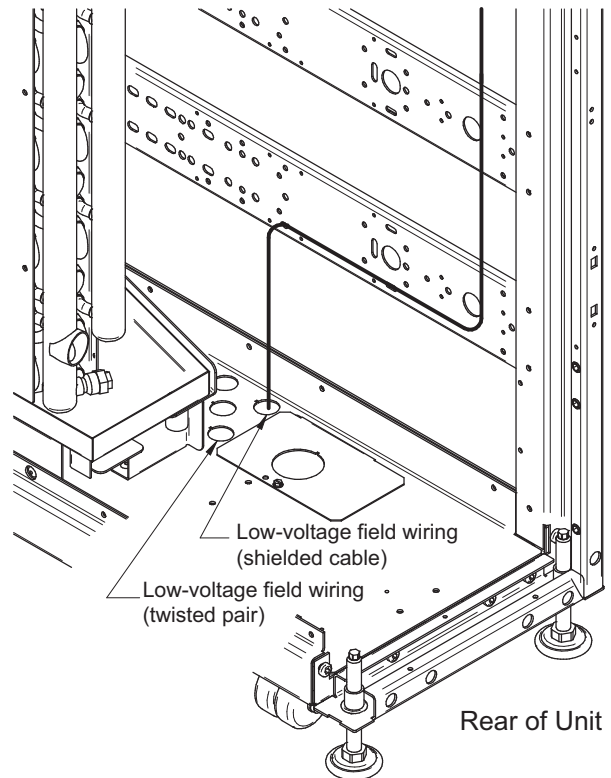


SOME COMPONENTS NOT SHOWN FOR CLARITY

General wire routing paths shown. Wiring must be run in conduit and must be inside Liebert CRV frame and panels. Attach conduit to inside of rails with cable ties.

Shielded cable may be used. If not, control wiring must be run in separate conduit from power wiring.

Secure the control wiring or conduit to the bottom edge of the rail with cable ties. Route the shielded cable up toward the Liebert IntelliSlot bays and fasten to the side rails as needed.



Secure tie the field wiring shielded cable to the rail. Route the shielded cable up toward the Liebert IntelliSlots and fasten to the side rails as needed.

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7.8 Dimensions—600mm (24in.) and 300mm (12in.) Models

Figure 60 Cabinet and floor planning dimensions—Chilled water, 600mm (24in.) wide models

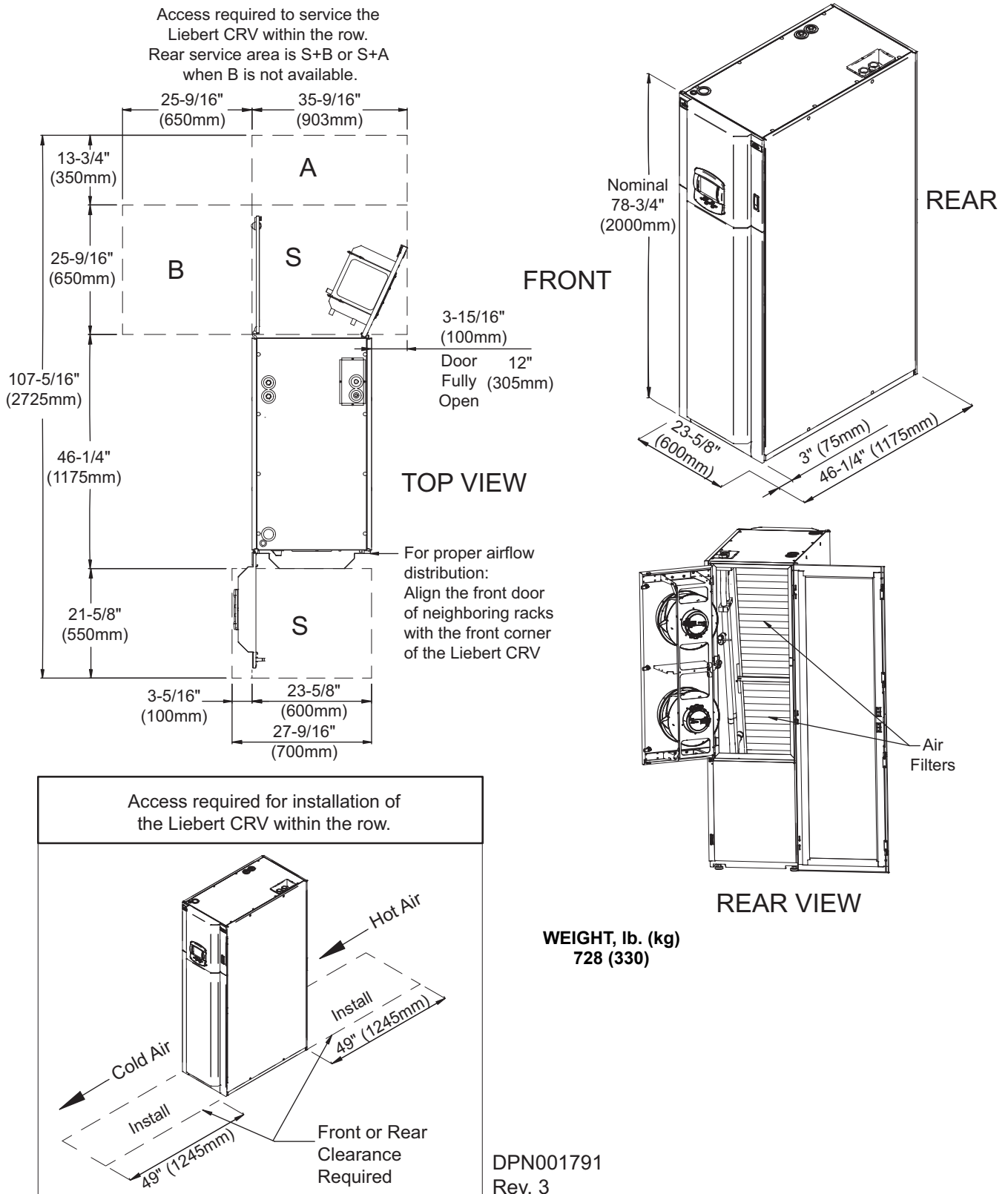
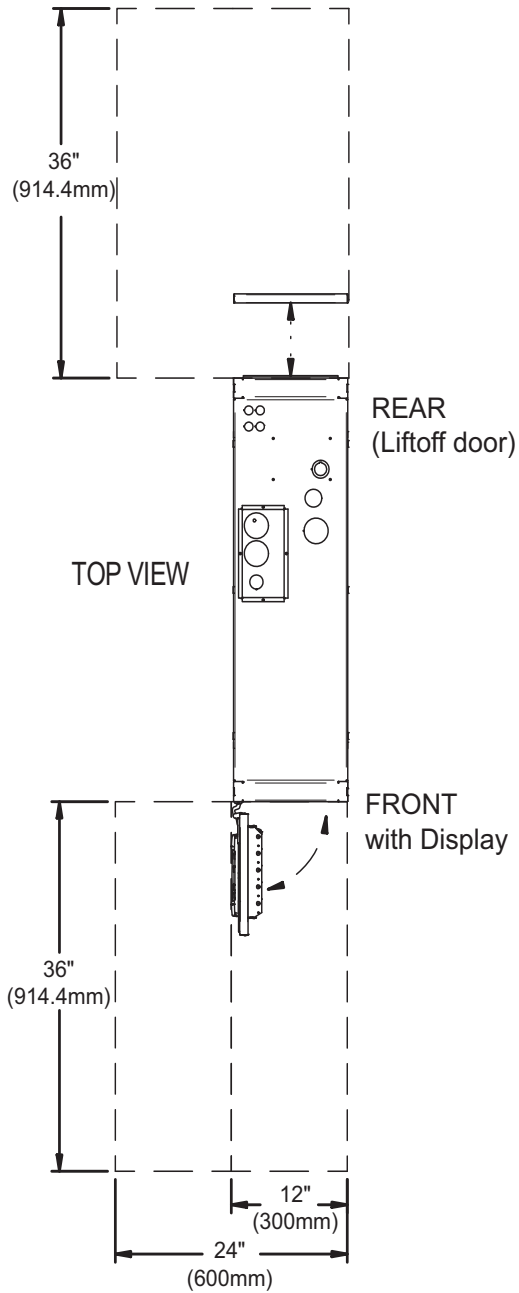


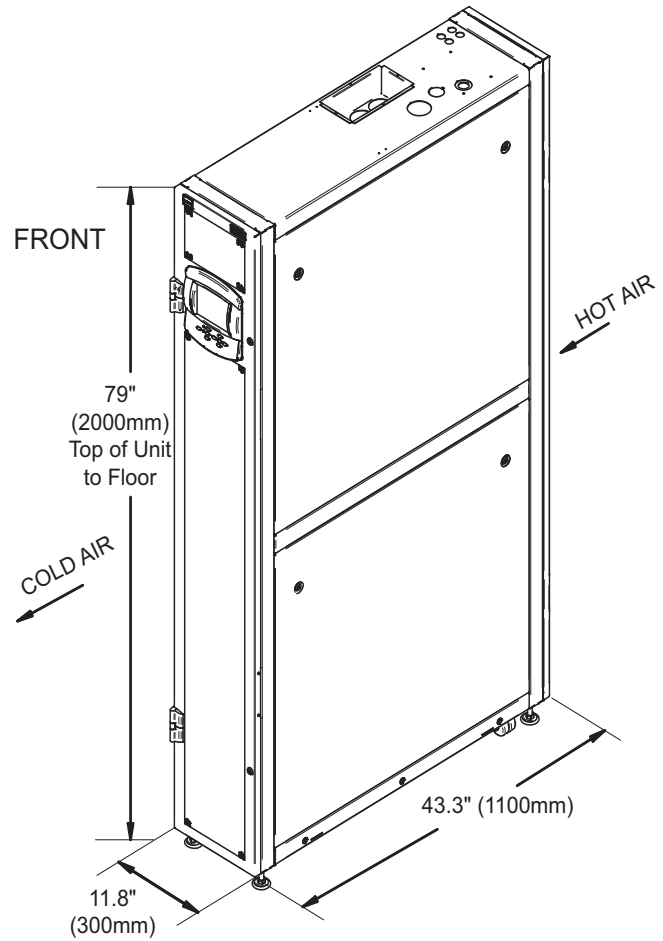
Figure 61 Dimensions and floor planning data, CR032 chilled water models, 300mm (12in.) wide

Access Required to Service the Unit
Between Existing Racks Within the Row



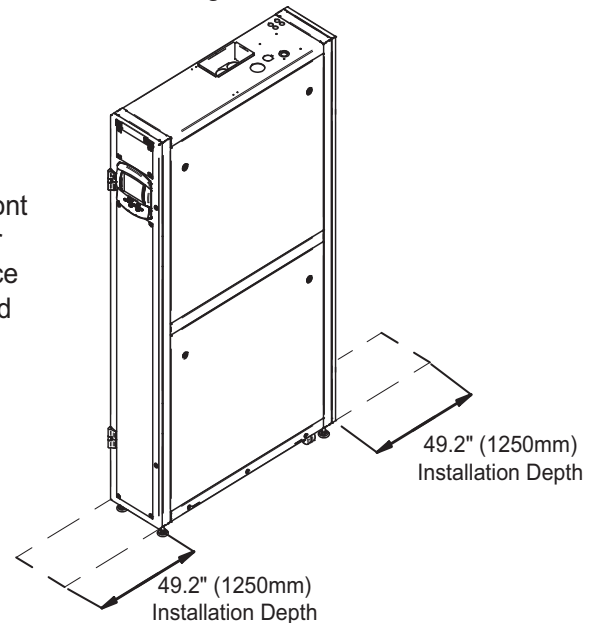
WEIGHT, lb. (kg)
190 (418)

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Access Required to Install the Unit
Between Existing Racks Within the Row

ONLY Front
or Rear
Clearance
Required



7.9 Piping—600mm (24in.) Units

Figure 62 Piping and electrical connections, chilled water models

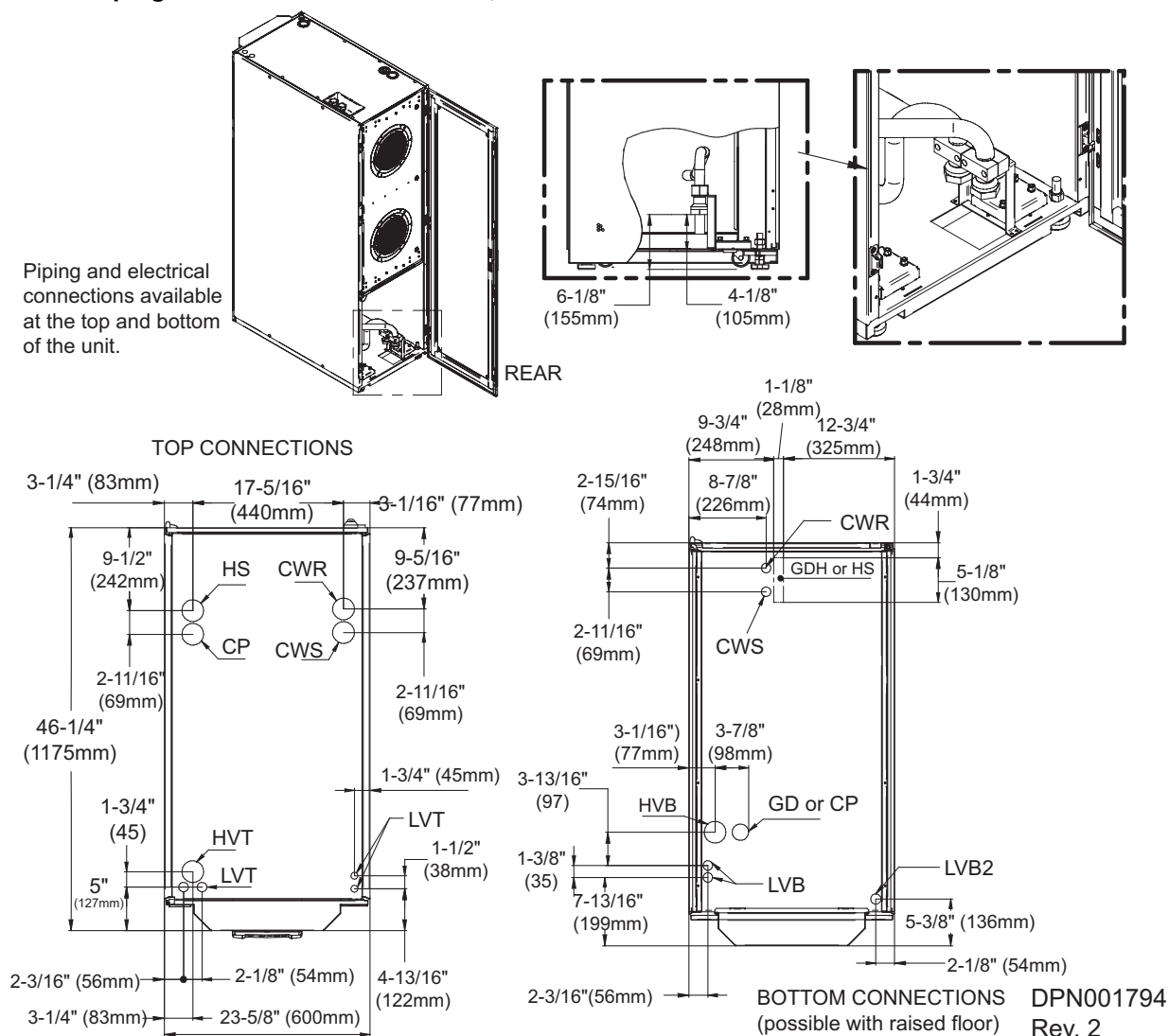
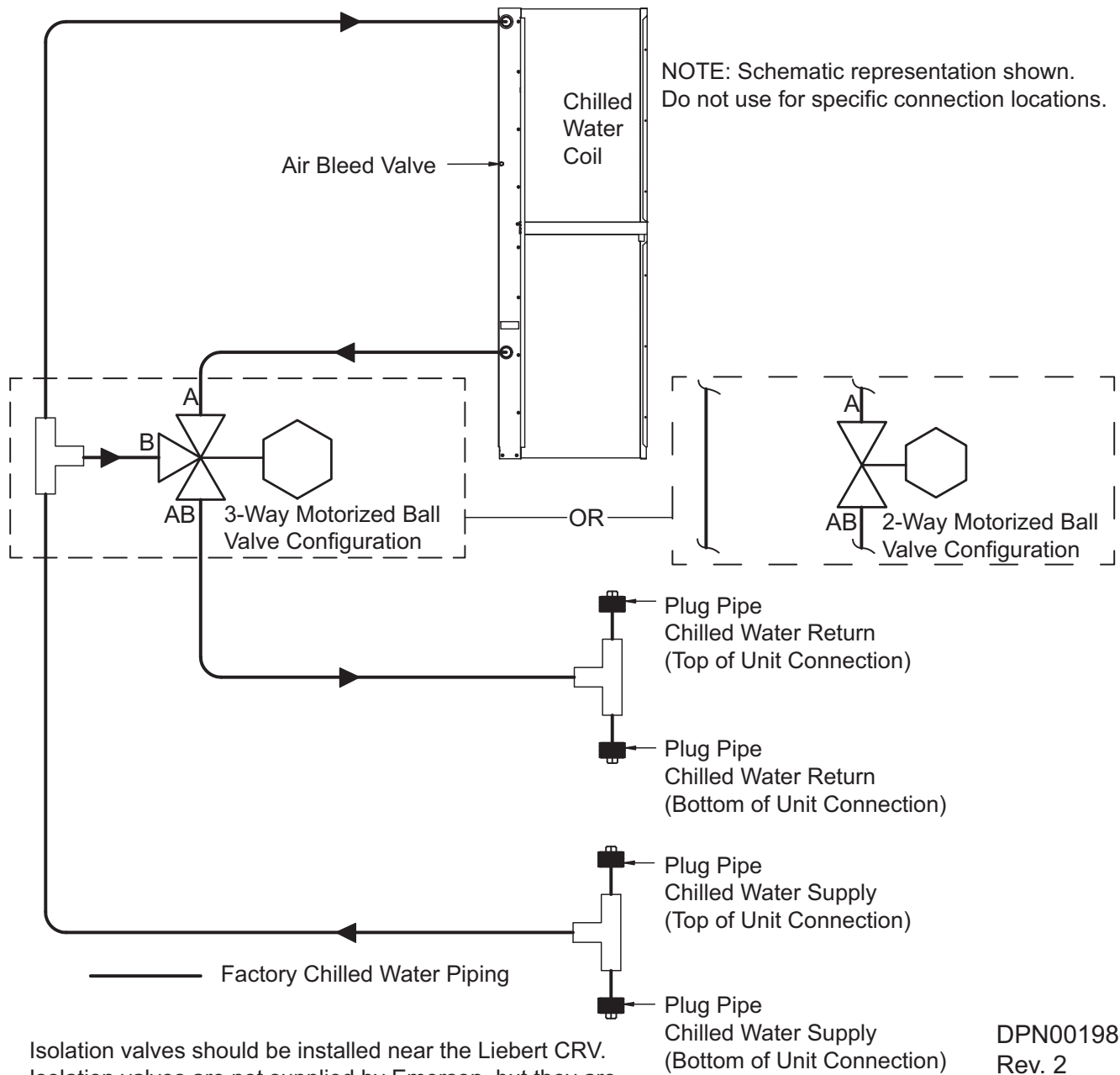


Table 50 Unit connections, chilled water models

Unit Connections		CR040C (60Hz)
CWS	Chilled Water Supply	1-1/4" FPT
CWR	Chilled Water Return	1-1/4" FPT
GD	Gravity Coil Pan Drain	1" MPT
GDH	Gravity Humidifier Drain	N/A
HS	Humidifier Supply	1/2" FPT (top connection), 1/4" Compression Fitting (bottom connection)
CP	Condensate Pump	1/2" FPT
HVT	High-Voltage Top Connection	Combination Knockout Hole Diameter 1-3/8" (35mm), 1-3/4" (44.5mm) and 2-1/2" (63.5mm)
HVB	High-Voltage Bottom Entrance (feed through the base of the unit)	Knockout Hole, 1, Diameter 2-1/2" (63.5mm)
LVT	Low-Voltage Top Connection	Knockout Holes, 4, Diameter 7/8" (22mm)
LVB	Low-Voltage Bottom Entrance (feed through the base of the unit)	Knockout Holes, 2, Diameter 1-3/32" (27.8mm)
LVB 2	Low-Voltage Bottom Entrance (feed through the base of the unit)	Knockout Hole, 1, Diameter 1-3/4" (44.5mm)

Source DPN001794, Rev. 2

Figure 63 General arrangement diagram—Chilled water CR040, 600mm (24) wide models



7.10 Piping—300mm (12in.) Units

Figure 64 Connections, CR032 chilled water models

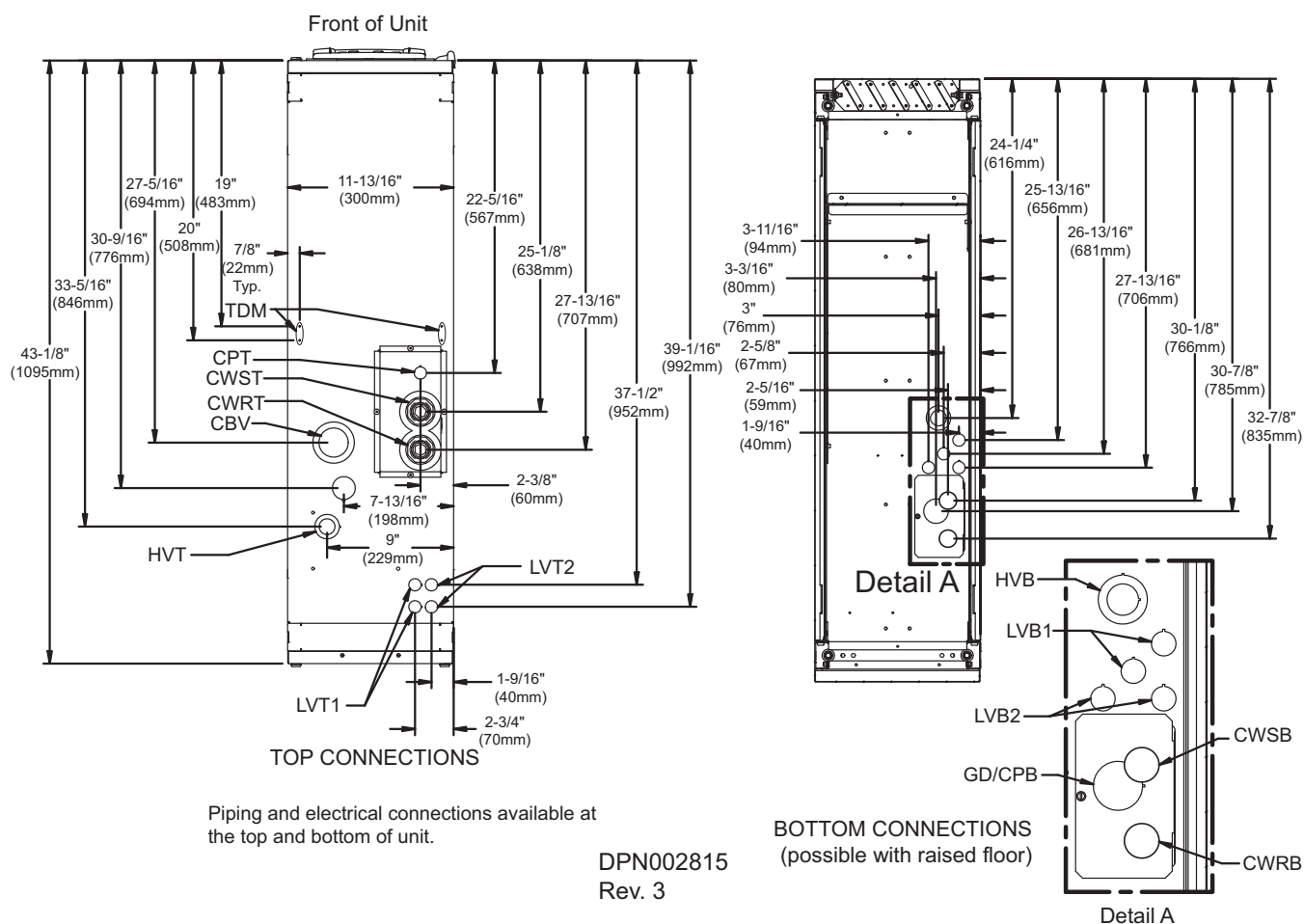
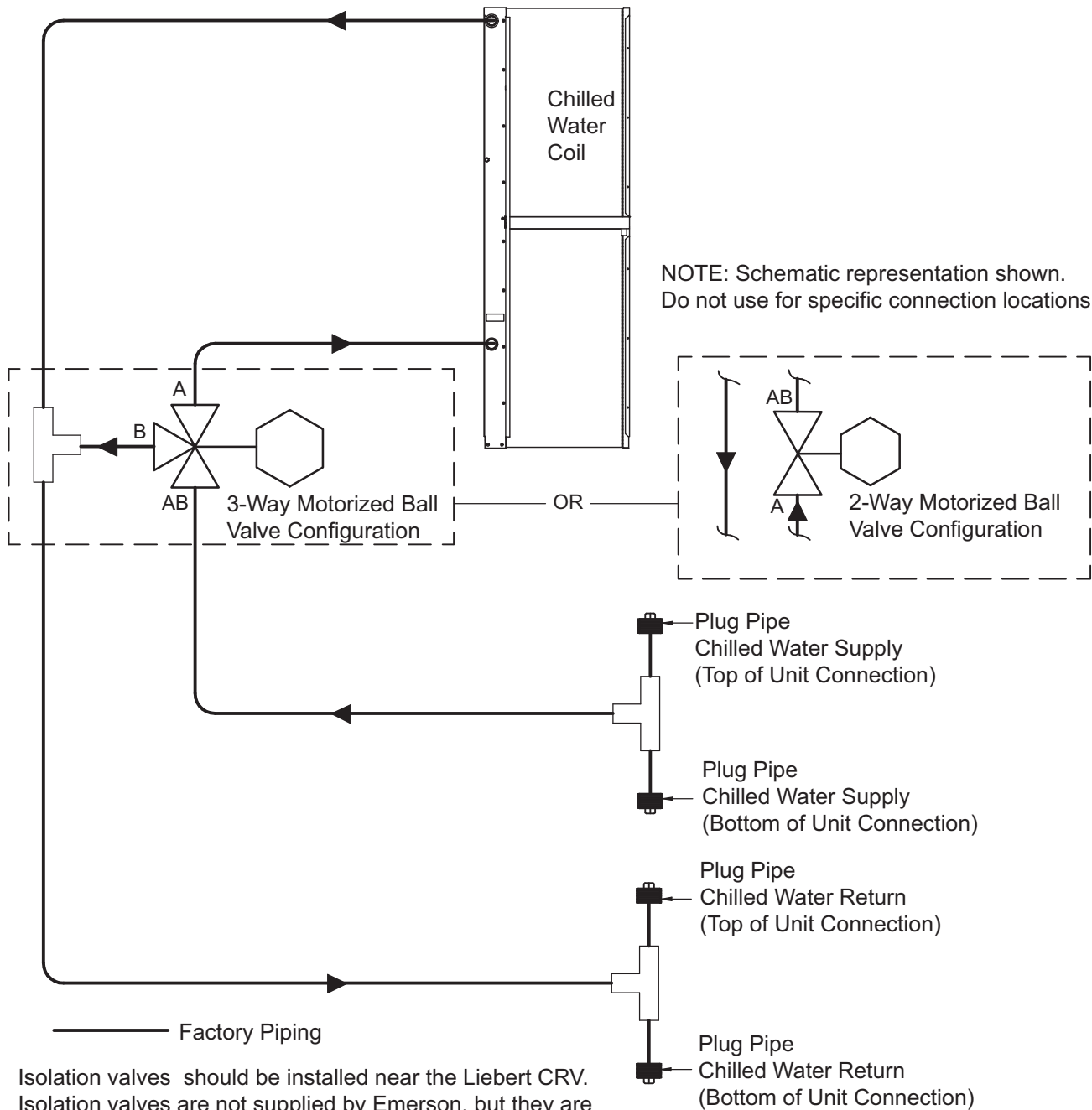


Table 51 Connections—Chilled water models, 300mm (12in.)

Unit Top Connections		CR032 (60Hz)	Unit Bottom Connections		CR032 (60Hz)
CWST	Chilled Water Supply	1-1/4" FPT	CWSB	Chilled Water Supply	1-1/4" FPT
CWRT	Chilled Water Return	1-1/4" FPT	CWRB	Chilled Water Return	1-1/4" FPT
CPT	Condensate Pump	Knockout, 3/4" (19mm)	GD	Gravity Coil Pan Drain	Knockout, 3/4" and 2" (19mm and 51mm)
CBV	Coil Bleeder (Schrader Valve)	Rubber Plug 2" (51mm)	CPB	Condensate Pump	
HVT	High-Voltage Top Connection	Combination Knockout 1-1/8" and 1-3/4" (29mm and 44mm)	HVB	High-Voltage Bottom Entrance (feed through the base of the unit)	Combination Knockout 1-1/8" and 1-3/4" (29mm and 44mm)
LVT1	Low-Voltage Top Connection (Twisted Pair)	Knockout Holes, 2, Diameter 7/8" (22mm)	LVB1	Low-Voltage Top Connection (Twisted Pair)	Knockout Hole Diameter, 7/8" (22mm)
LVT2	Low-Voltage Top Connection (Shielded Cable)	Knockout Holes, 2, Diameter 7/8" (22mm)	LVB2	Low-Voltage Top Connection (Shielded Cable)	Knockout Hole Diameter, 7/8" (22mm)
TDM	Tie-Down Mounting (Top)	Hole Diameter 1/8" (3mm) 4 Places	Source: DPN002815, Rev. 3		

Figure 65 General arrangement CR030 and CR034 chilled water models 300mm (12in.)



Isolation valves should be installed near the Liebert CRV. Isolation valves are not supplied by Emerson, but they are required for proper circuit operation and maintenance.

DPN002976
Rev. 0

7.11 Sound Data—600mm (24in.) and 300mm (12in.) Chilled Water Systems

Tables 52 and 53 show the sound pressure level in free field at 5ft. (1.5m) high and 6-1/2ft. (2m) in front of the air conditioner, with compressor and fan in operation. The sound data is without the Low Sound Package compressor jacket and sound deadening panel insulation installed.

Sound power is an absolute measurement that can be used for comparisons. Sound pressure values can be used for comparisons only when all sound measurement parameters match exactly.

Table 52 Sound data—CR040RW, 600mm (24in.) chilled water

2 Fans with Filter			Sound Power Level (PWL)										Sound Pressure Level (SPL)
Fan Speed %	Airflow		Octave Band Frequency (Hz)										At Suction side, 2m distance, free field conditions (2m, f.f, dBA)
	SCFM	m ³ /h	31.5 dB	63 dB	125 dB	250 dB	500 dB	1000 dB	2000 dB	4000 dB	8000 dB	A-Scale Weighted dB (A)	
100	3325	5650	86.4	78.1	82.4	84.6	79.2	75	76.4	70.9	63.8	82.8	71.6
75	2708	4600	80.8	72.5	76.8	79	73.6	69.4	70.8	65.3	58.2	77.2	66.0
50	1972	3350	75.1	66.8	71.1	73.3	67.9	63.7	65.1	59.6	52.5	71.5	60.3

Level PWL sound power level

Table 53 Sound data—CR032RC, 300mm (12in.)

6 Fans With Filter			Sound Power Level (PWL)											Sound Pressure Level (SPL)		
Fan Speed %	Airflow		Octave Band Frequency (Hz)									A-Scale Weighted dB(A)	Inlet dB(A)	Outlet dB(A)	At Suction Side, 2 m distance, 1.5m above ground, free field conditions (2m, f.f, dBA)	At Discharge side, 2 m distance, 1.5m above ground, free field conditions (2m, f.f, dBA)
	SCFM	m³/h	31.5 dB	63 dB	125 dB	250 dB	500 dB	1000 dB	2000 dB	4000 dB	8000 dB					
100	3100	5268	—	—	73.0	83.1	82.2	82.0	78.9	71.0	65.5	86.2	77.5	83.4	66.5	72.4
75	2500	4248	—	—	70.5	79.8	79.9	78.2	74.7	66.7	63.1	82.4	73.5	80.7	62.5	69.7
50	1650	2804	—	—	71.9	66.8	68.0	65.8	60.3	56.0	52.6	70.2	62.8	71.0	51.8	60.0

7.12 Standard Features—600mm (24in.) Chilled Water Systems

Source: DPN001906, Rev. 5

Chilled Water Cooling Coil—The evaporator coil has 7.25 ft² (0.674 m²) face area, six rows deep. It is constructed of copper tubes and hydrophilic-coated aluminium fins. The hydrophilic coating provides superior water carryover resistance. Two stainless steel condensate drain pans are provided.

Chilled Water System—The water circuit includes a three-way modulating valve. The Liebert iCOM positions the valve in response to room conditions. Cooling capacity is controlled by bypassing chilled water around the coil.

Fan—The unit is equipped with two plug fans, direct-driven centrifugal fans with backward-curved blades and electronically commutated DC motors, commonly referred to as EC plug fans. The fan speed is variable and automatically regulated by the Liebert iCOM through all modes of operation. Each fan has a dedicated motor and speed controller that provides a level of redundancy. The fans are on the rear panel of the unit and push air through the coil.

Three-Way Modulating Valve—A three-way modulating valve controls the chilled water flow passing through the cooling coil. The Liebert iCOM manages the valve actuator movement to provide the desired amount of cooling for various entering water temperatures. Cooling capacity is regulated by bypassing chilled water around the coil. The maximum differential pressure across the closed valve is 200 PSI (1379 kPa). Maximum system pressure is 325 PSI (2241 kPa).

Supply Air Baffle—A field-adjustable, modular supply air baffle is located in the discharge air stream. It can be quickly and easily reconfigured to redirect airflow. The angles of the vanes have been optimized to effectively distribute air to heat generating equipment in a wide variety of applications.

Liebert iCOM—The Liebert CRV is controlled by the Liebert iCOM. The standard user interface is the large graphical display (320x240 pixels, backlit), which presents system information and allows all parameters to be viewed and adjusted. It features push-button navigation, operational status LED's, and a three-level password protection system. Unit-to-Unit communication with other Liebert CRV's and two Liebert IntelliSlot communication card housings are included as standard.

2T Rack Temperature Sensors—Each consists of a vented case with two temperature probes. Three 2T rack sensors are standard with each Liebert CRV. Up to ten 2T housings (20 temperature probes) can be connected to a Liebert CRV. One 2T housing and both sensor probes are to be attached to a rack the Liebert CRV is cooling. The sensors provide real-time, direct feedback to the cooling unit to optimize the amount of cooling and airflow required, increasing energy efficiency and ensuring proper rack inlet air temperatures. The sensor data can also be reported to remote BMS and monitoring systems. The sensor network consists of one CAN wire leaving the cooling unit and connecting to a 2T sensor. Each remaining 2T sensor is connected to the previous sensor in a daisy-chain configuration.

Remote Shutdown Terminal—Provides a location to remotely shut down the unit.

Common Alarm Contact Provides a set of normally open (N/O) contacts for remote indication of unit alarms.

Cabinet—The exterior steel panels are custom powder-coated to protect against corrosion. The double-wall side panels separate the half-inch, 2.0 lb/ft³ insulation from the airstream. The unit is mounted on casters for quick installation and provided with levelling feet. The perforated inlet and outlet panels have 81% open area. The rear door utilizes a Knurr rack-style handle and hinges.

Service Access—All service and maintenance is performed through the front or rear of the unit, including any component removal. No side access is required. All electrical and piping connections are made through the top and/or bottom of the unit. All units are provided with a superior service access panel to provide additional access.

Filter—The unit is equipped with two deep-pleated, 4-inch filters rated MERV8 (based on ASHRAE 52.2-2007), located in the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

Locking Disconnect Switch—A molded case circuit interrupter disrupts the flow of power to the unit. The electric panel high-voltage compartment can be accessed only with the switch in the Off position. Conveniently located behind the Liebert iCOM display door for quick access.

65,000 Amp Short Circuit Current Rating (SCCR)—The electrical panel provides a 65k amp SCCR.

7.13 600mm (24in.) Chilled Water Optional Features

Source: DPN001909, Revision 5

Dual-float Condensate Pump—It has a capacity of 6 GPM (22.7 l/min) at 30ft (9 m) head. Pump is complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float sends a signal to the local alarm and shuts down the unit upon high water condition.

Humidifier—A steam-generating canister humidifier is factory-installed in the cooling unit and is operated by the Liebert iCOM. It is complete with disposable cylinder, all supply and drain valves, steam distributor and electronic controls. The need to change the canister is indicated on the iCOM display. The humidifier is designed to operate with water conductivity from 125-500 (50Hz) or 330-670 (60Hz) microS/cm. System automatically fills and drains as well as maintains the required water level based on conductivity. An air-gap within the humidifier assembly prevents back-flow of the humidifier supply water. The humidifier is removable from the rear of the cabinet.

Electric Reheat—The electric reheat coils are low-watt density, 304 stainless steel, fin-tubular construction, protected by thermal safety switches and controlled in one stage.

Two-Way Modulating Valve—A two-way modulating valve controls the chilled water flow passing through the cooling coil. The Liebert iCOM manages the valve actuator movement to provide the desired amount of cooling for various entering water temperatures. Cooling capacity is regulated by varying the chilled water flow. The maximum differential pressure across the closed valve is 200 PSI (1379 kPa). Maximum system pressure is 325 PSI (2241 kPa).

Liebert IntelliSlot Web Card (IS-WEBL)—Provides ground-fault isolated 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include SNMP for Network Management Systems, HTTP for Web page viewing, SMTP for e-mail and SMS for mobile messaging.

Liebert IntelliSlot 485 Card (IS-485L) Provides ground fault isolated RS-485 Modbus network connectivity to Building Management Systems for unit monitoring and management.

Liebert IntelliSlot BUILDING MANAGEMENT CARD (IS-IPBML) Provides ground fault isolated Modbus IP

network connectivity to Building Management Systems for unit monitoring and management.

Liebert IntelliSlot SiteLink-E Card (IS-485EXI) Provides ground fault isolated connection to a Liebert SiteLink-E for monitoring and management. Compatible with Liebert SiteScan Web 4.0 or newer version.

Filter—The optional filters are two deep-pleated, 4-inch, rated MERV11 following ASHRAE 52.2 (60-65% by ASHRAE 52.1), located within the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

Reheat/Humidifier Lockout—Includes the necessary relays to disable the reheat and humidifier from an external 24V signal.

One Extra Common Alarm Contact—Provides two sets of normally open (N/O) contacts for remote indication of unit alarms.

Liebert Liqui-tect Sensor—Solid-state water sensor hermetically sealed to keep out dust and dirt. The alarm system is activated when the sensor detects moisture.

7.14 Standard Features—300mm (12in.) Chilled Water Systems

Source: DPN002974, Rev. 3, Pg. 3

Chilled Water Cooling Coil—The 300 series evaporator coil is three rows deep with the 32kW model having 7.8ft² (0.72m²) of face area. It is constructed of copper tubes and hydrophilic-coated aluminum fins. The hydrophilic coating provides superior water carryover resistance. A stainless steel condensate drain pan is provided.

Chilled Water System—The water circuit includes a three-way modulating ball valve. The Liebert iCOM positions the valve in response to room conditions. Cooling capacity will be controlled by bypassing chilled water around the coil. The maximum differential pressure across the closed valve is 200 PSI (1379 kPa). Maximum system pressure is 325 PSI (2241 kPa).

Fans—The unit is equipped with six plug fans: direct driven centrifugal fans with backward-curved blades and electronically commutated motors, commonly referred to as *EC plug fans*. The fan speed is variable and automatically regulated by the Liebert iCOM through all modes of operation. Each fan has a dedicated motor and integrated speed controller, which provides a level of redundancy. The fans are in the front of the unit and pull air through the coil.

Supply Air Baffle—Field-adjustable modular supply air baffles are located in the discharge air stream. They can be quickly and easily reconfigured to redirect airflow.

Liebert iCOM Control—The Liebert CRV is controlled by the Liebert iCOM. The standard user interface is the large graphical display (320x240 pixels, backlit), which presents system information and allows all parameters to be viewed and adjusted. It features push-button navigation, operational status LED's and a three-level password protection system. Unit-to-Unit communication with other Liebert CRV's and two Liebert IntelliSlot™ communication card housings are included as standard.

2T Rack Temperature Sensors—Each consists of a vented case with two temperature probes. Three 2T rack sensors are standard with each Liebert CRV. Up to ten 2T housings (20 temperature probes) can be connected to a Liebert CRV300. One 2T housing and both sensor probes are to be attached to a rack the Liebert CRV is cooling. The sensors provide real-time direct feedback to the cooling unit to optimize the amount of cooling and airflow required, increasing energy efficiency and ensuring proper rack inlet air temperatures. The sensor data can also be reported to remote BMS and monitoring systems. The sensor network consists of one CAN wire leaving the cooling unit and connecting to a 2T sensor. Each remaining 2T sensor is connected to the previous sensor in a daisy-chain configuration.

Remote Shutdown Terminal—Provides a location to remotely shut down the unit.

Common Alarm Contact—Provides a set of normally open (N/O) contacts for remote indication of unit alarms.

Cabinet—The exterior steel panels are custom powder-coated to protect against corrosion. The unit is mounted on casters for quick installation and provided with leveling feet. The perforated inlet and outlet panels have 81% open area. The front door is hinged; the rear door may be lifted off the unit.

Service Access—All service and maintenance is performed through the front or rear of the unit, including any component removal. No side access is required. All electrical and piping connections are made through the top and/or bottom of the unit.

Filter—The unit is equipped with two 1/2 inch filters rated MERV1 (based on ASHRAE 52.2-2007), located within the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

Locking Disconnect Switch—A molded case circuit interrupter disrupts the flow of power to the unit. The electric panel high-voltage compartment can be accessed only with the switch in the Off position. Located behind the rear door and filters for access.

Short Circuit Current Rating (SCCR)—The electrical panel provides a 65k amp SCCR for 208V and 460V units and 5k amp SCCR rating for 120V units.

7.15 300mm (12in.) Chilled Water Optional Features

Source: DPN002973, Rev. 1

Dual-float Condensate Pump—Capacity of 45 GPH (171 l/hr) at 13ft (4m) head. Pump is complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.

2-way Modulating Valve—A two-way modulating valve controls the chilled water flow passing through the cooling coil. The iCOM control manages the valve actuator movement in order to provide the desired amount of cooling for various entering water temperatures. Cooling capacity is regulated by varying the chilled water flow. The maximum differential pressure across the closed valve is 200 PSI (1379 kPa). Maximum system pressure is 325 PSI (2241 kPa).

Liebert IntelliSlot™ Sitelink-E® Card (IS-485EXI)—Provides ground fault isolated connection to a Liebert SiteLink-E for monitoring and management. Compatible with Liebert SiteScan Web 4.0 or newer version.

Liebert IntelliSlot Unity™ Card (IS-UNITY-DP) Provides ground fault isolated RS-485 Modbus, BACnet IP & Modbus IP network connectivity to Building Management Systems for unit monitoring and management. Also, provides ground fault isolated 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include: SNMP for Network Management Systems, HTTP for web page viewing, SMTP for e-mail, and SMS for mobile messaging. This card can support dual IP and 485 protocols simultaneous.

Filter—The optional filters are two deep pleated 2 inch rated MERV8 (based on ASHRAE 52.2-2007) located within the cabinet and accessible from the rear of the unit. A filter clog alarm is included.

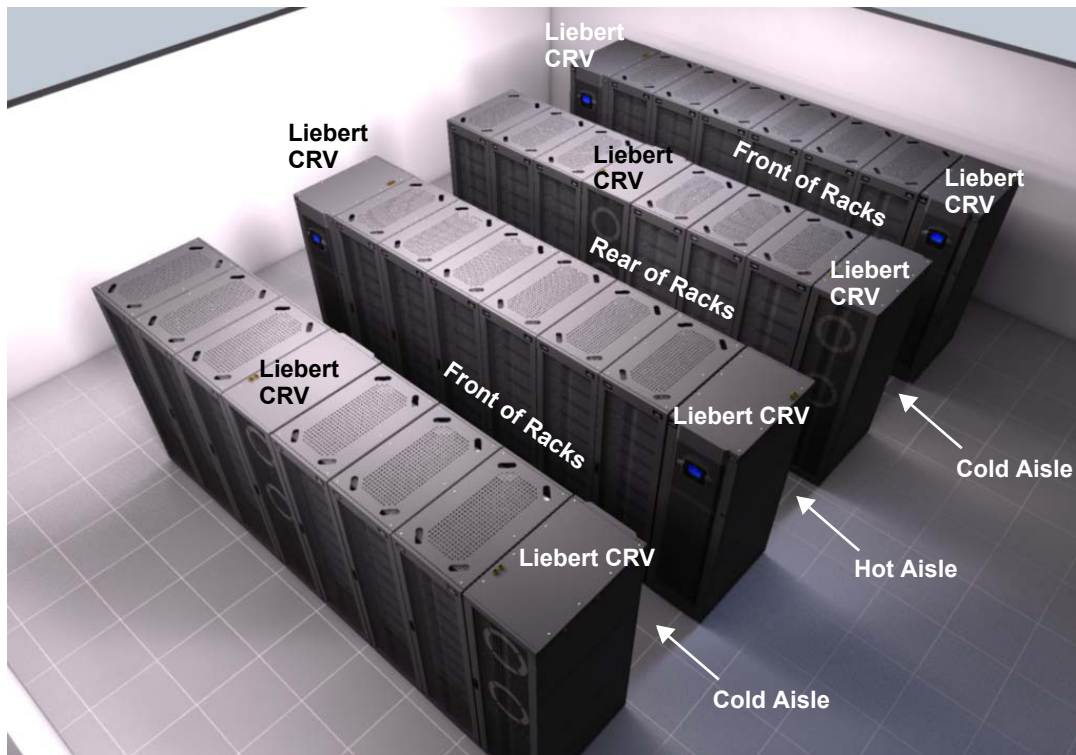
One (1) Extra Common Alarm Contact—Provides two sets of normally open (N/O) contacts for remote indication of unit alarms.

Liebert Liqui-tect® Sensor—A solid state water sensor hermetically sealed to keep out dust and dirt. When the sensor detects the presence of moisture the alarm system is activated.

APPENDIX A - LIEBERT CRV INTENDED APPLICATION

The Liebert CRV can be applied in virtually any application. Since the unit provides complete temperature and humidity control along with filtration, it can be deployed as the only cooling unit in smaller data centers and network closets. Larger data centers are able to benefit from its standard rack-sized footprint, deploying it as a supplemental spot cooler to address both hot spots and high-density racks. The small footprint and variable cooling and airflow allow the unit to be initially oversized in anticipation of future IT expansion with minimal footprint or energy consumption penalties. The unit can be applied on both raised and non-raised floors, allowing it work with existing under floor and overhead cooling systems. The unit is compatible with all forms of aisle containment, but the control algorithms have been optimized for cold aisle containment with SmartAisle™ from Emerson Network Power®.

Figure 66 Example of high-density installation with alternating cold and hot aisles



A.1 UNIT-TO-UNIT (U2U)—COORDINATED COOLING OPERATION

The Liebert iCOM controls permit networking the Liebert CRV's and coordinating the units' operation to improve cooling and efficiency. In U2U mode, the networked Liebert CRV's share data from the standard temperature sensors to increase or reduce cooling. For further information, see:

- 3.10 - Standard Features—600mm (24in.) Air-Cooled Systems
- Figure 43 - Piping connections, 600mm (24in.) wide water/glycol-cooled models
- 7.12 - Standard Features—600mm (24in.) Chilled Water Systems
- 7.14 - Standard Features—300mm (12in.) Chilled Water Systems

A.2 SMARTAISLE™ CONFIGURATION

The SmartAisle from Emerson Network Power® is an intelligent row-based system that integrates data center racks, power, row cooling, aisle containment, monitoring and control technologies into a complete data center layout.

A.2.1 Typical SmartAisle Components

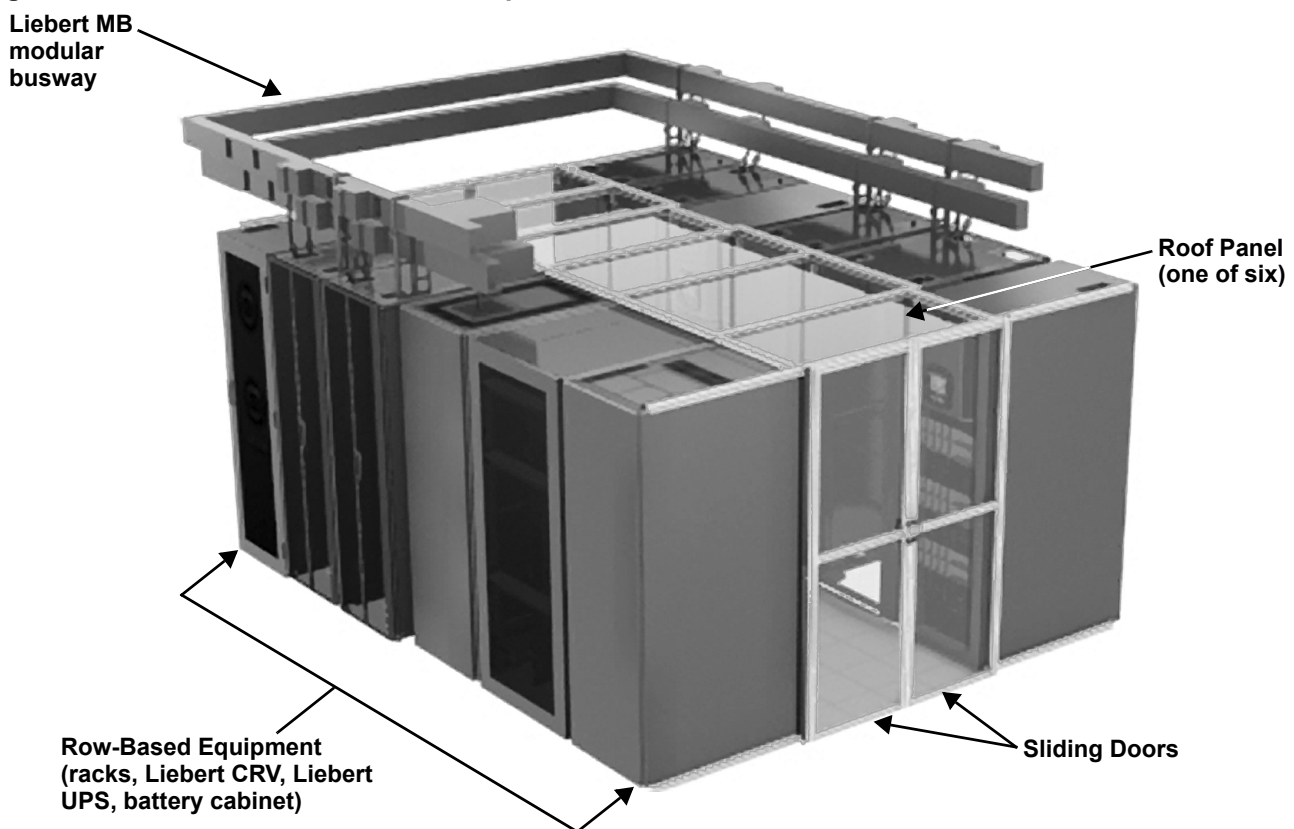
Each SmartAisle from Emerson is custom-designed, offering the most favorable layout for the installation. The design takes into account the equipment required, equipment sizes (with the heat load or power consumption), cooling equipment type (chilled water or water/glycol based) and whether cooling or power redundancy is desired.

Some typical components are:

Liebert APM™	DCF™ or DCM™ Cabinets
Liebert Battery Cabinets	Modular Containment
Liebert BDC™	Liebert MB™
Liebert CRV	Liebert PDU's

Depending on heat load and power requirements, there may be multiple Liebert Thermal Management units and multiple AC Power Protection and Distribution units.

Figure 67 SmartAisle™ installation example



A.3 PLACING LIEBERT CRV UNITS IN ROWS OF RACKS FOR EFFICIENCY

This chapter provides examples of typical Liebert CRV installations. For best performance of the Liebert CRV, observe the following guidelines:

- Create defined hot and cold aisles: eliminate gaps between server racks and utilize blanking plates to fill open sections within the racks.
- Install the 2T rack temperature sensors on the front door of all equipment the Liebert CRV is cooling.
- Use walls or opposing racks to minimize the width of the hot and cold aisles; target 2-6 ft. (0.6 to 1.8m)

For site specific recommendations on how to optimize your space for row based cooling, contact your local Emerson representative.

A.3.1 Row Placement

The Liebert CRV can be placed either at the end of a row or in between server racks. Locating a Liebert CRV at the end of a row helps to isolate the end of the cold aisle from the surrounding space; protecting it from hot air wrapping around the sides of the aisle. The 2T rack temperature sensors sample supply and return air temperatures.

When deploying multiple Liebert CRV's it is recommended that units be installed at the end of rows with their baffles set to direct cold supply air toward the server equipment (**Figure 68**). Depending on row length, heat density and airflow requirements, additional cooling units can be installed throughout the row with their baffles set to direct supply air left and right as it leaves the unit as seen in **Figure 69**.

Cooling unit location within a row becomes less critical when deployed in SmartAisle™ containment, but it is recommended that Liebert CRV's be evenly spaced in each row. Using room barriers, such as walls shown in **Figure 70** and **Figure 71**, can be very effective in simulating aisle containment. When the depths of a Liebert CRV and neighboring server rack are not the same, it is important to align the front edges of the Liebert CRV with the front edges of the neighboring server racks to allow for proper air distribution.

Figure 68 One Liebert CRV, recommended placement

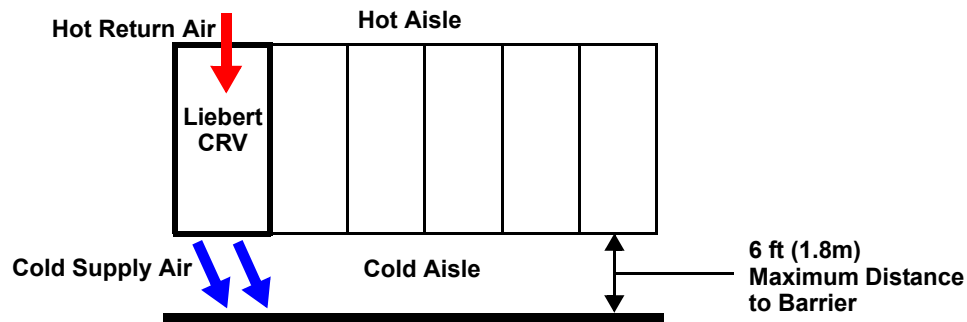


Figure 69 One Liebert CRV, alternate placement

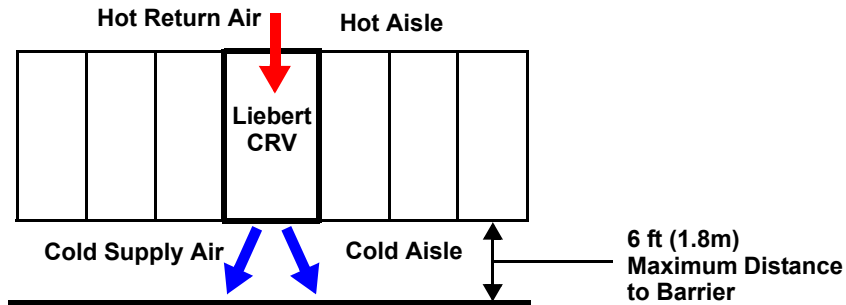


Figure 70 Simulated aisle containment using room barriers—single row

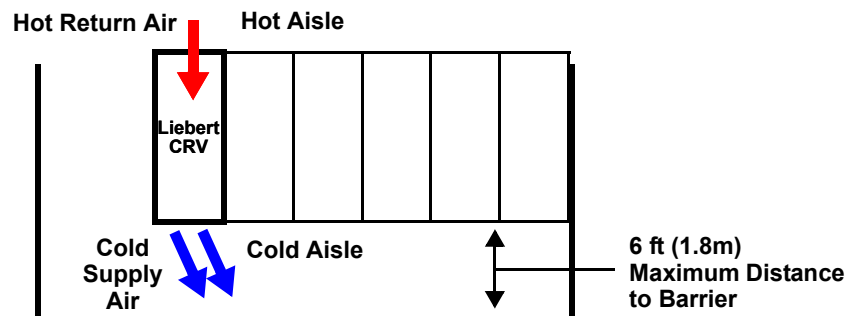
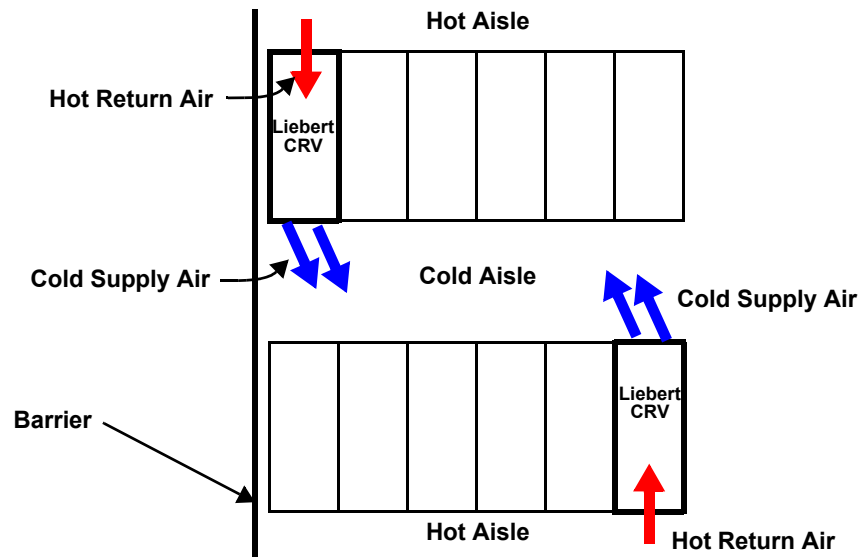
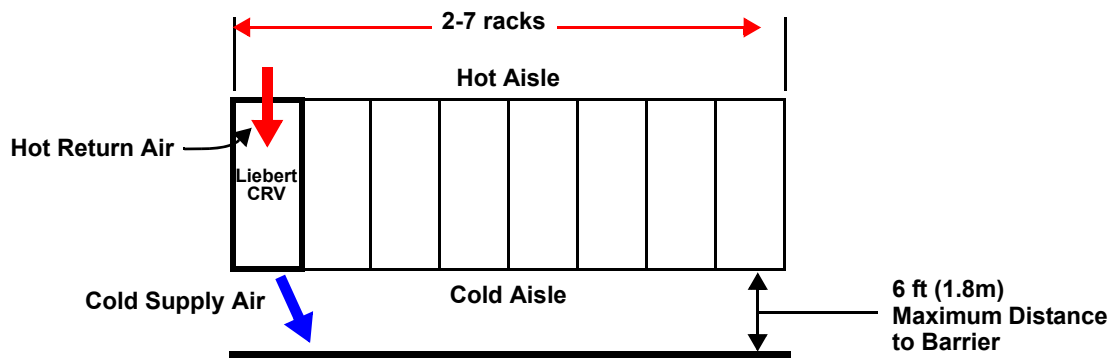


Figure 71 Simulated aisle containment using room barriers—multiple rows

A.3.2 Number of Racks / Row Length

The number of racks the Liebert CRV can condition depends on the equipment's heat load and airflow requirements. It is recommended to oversize the Liebert CRV by approximately 20% to account for gaps where cold air is lost through server racks, obstructions (pillars, people, partly open rack doors) reducing air distribution efficiency and error in estimating server equipment heat and airflow requirements. When deployed with SmartAisle™ cold aisle containment, the Liebert CRV can be more closely matched to the server equipment needs.

When the Liebert CRV is significantly oversized, the cooling unit is able to effectively distribute air six to seven racks away. Initially oversizing the unit provides for future data center flexibility with nearly no energy consumption or footprint penalty. The intelligent Liebert iCOM® control and variable system components allow the unit to minimize its operations without sacrificing environmental control.

Figure 72 Number of racks, row length

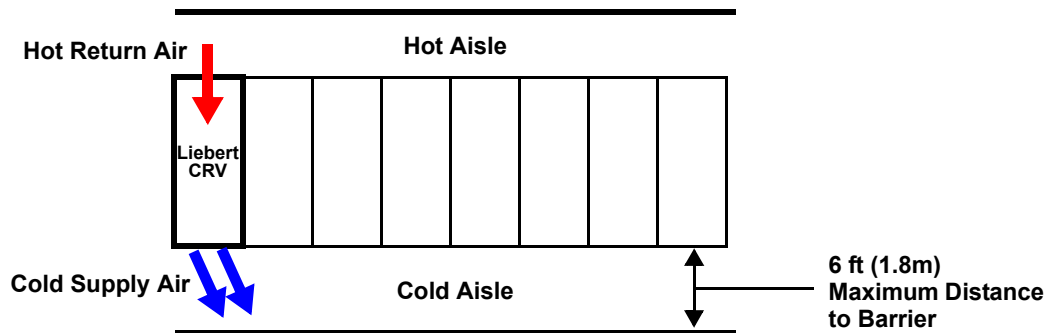
A.4 PLACEMENT IN THE ROOM

A.4.1 Depth of Hot Aisle-Cold Aisle

For optimal air distribution, use opposing racks or walls to clearly define the hot and cold aisles. This will help to create an efficient and effective air circulation path from the cooling unit, to the server racks, and back to the cooling unit. This helps to avoid cold air being lost to the room and prevents hot air from entering the cold aisle. The supply air baffle has been optimized for aisle spacing of 2 to 6 feet wide.

Emerson's® SmartAisle™ cold aisle containment system is recommended for maximum performance. While the Liebert CRV is compatible with all forms of aisle containment, its control algorithms have been optimized for partial and full cold aisle containment, allowing for increased operating efficiency and reducing the number of 2T rack sensors.

Figure 73 Depth of hot / cold aisles



A.5 REDUNDANCY ARRANGEMENT

When laying out row-based units for redundancy, it is better to run all units at a lower operating level than to shut off extra units. The units must be sufficiently sized to achieve the required cooling capacity if any of the other units within the same row fail. **Figure 74** shows an example of N+1 redundancy properly applied.

Figure 74 Example of an application with one row and N+1 redundancy—left side unit failed

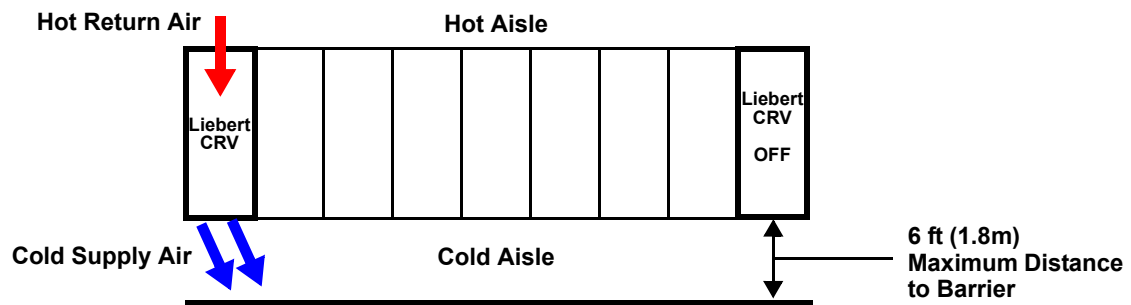
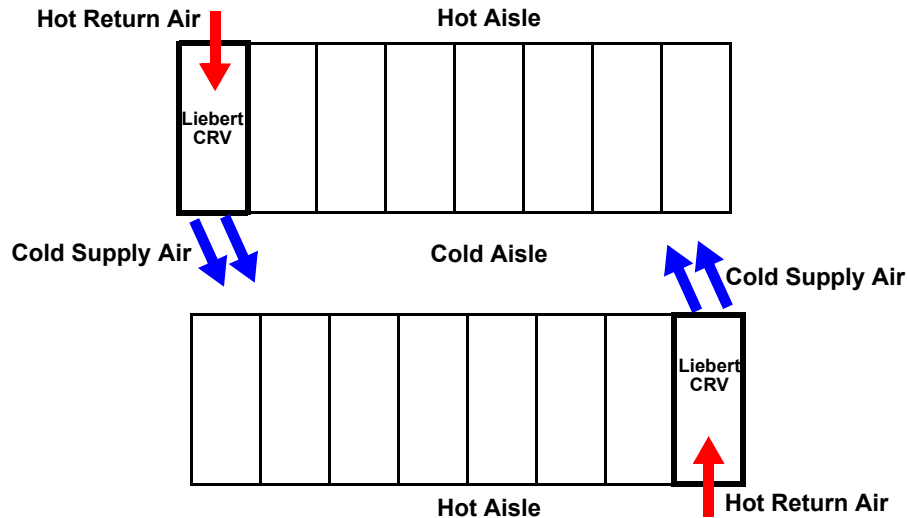


Figure 75 Example of an application with two rows and N+1 redundancy—unit at lower left failed



A.6 LIEBERT CRV APPLIED IN SMARTAISLE™ COLD AISLE CONTAINMENT

Using the Liebert CRV with the SmartAisle is always recommended but not required. It is an excellent solution when attempting to cool widely varying heat loads, loads exceeding 10kW per rack, and when seeking the highest efficiency systems. For additional information about the SmartAisle, see the Emerson® Web site: www.emerson.com

Figure 76 Liebert CRV placement with SmartAisle cold aisle containment—Liebert CRV's in center of two rows

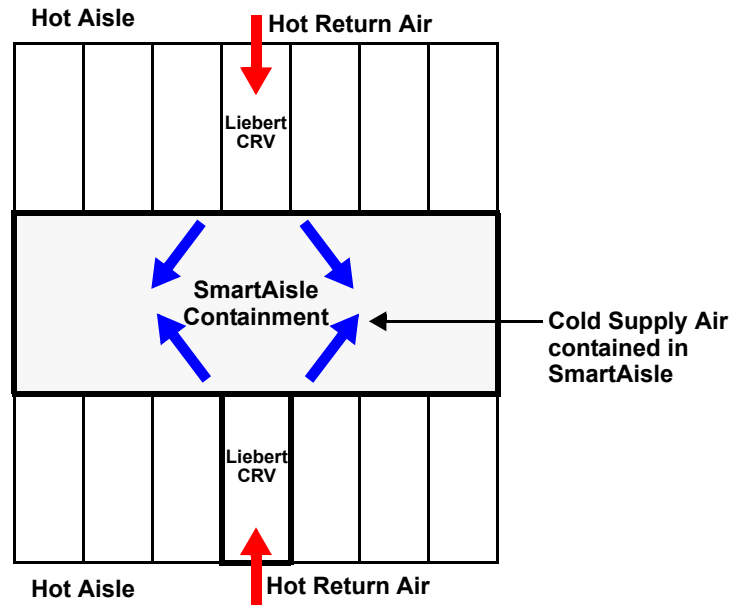
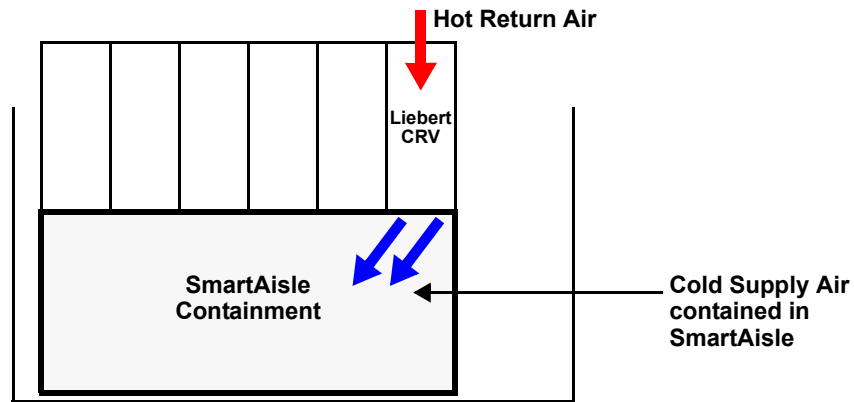


Figure 77 Liebert CRV placement with SmartAisle™ cold aisle containment—Liebert CRV at end of one row

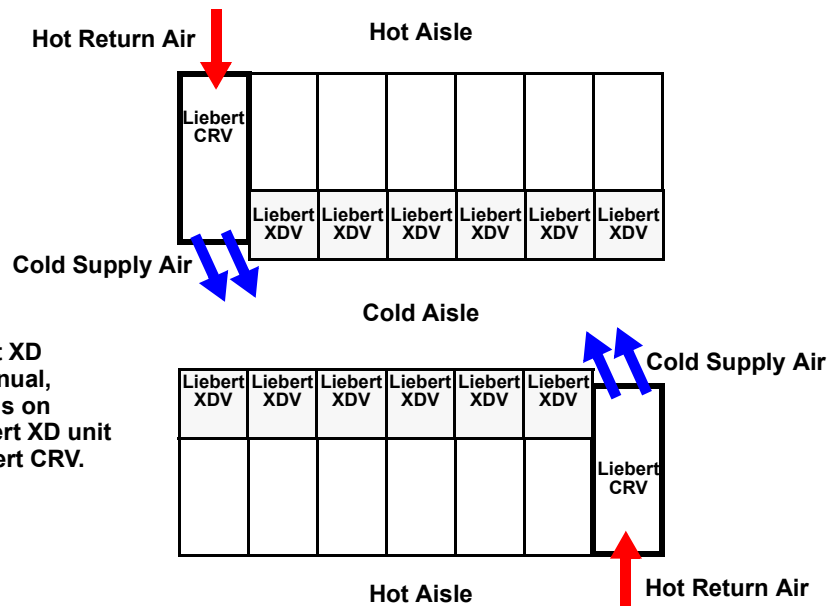


A.7 LIEBERT CRV AND LIEBERT XD™ SYSTEMS

When larger spaces (approximately 20 racks or more) require high-density cooling, row-based Liebert CRV's can be used to support Liebert XD cooling systems. When used together, these systems are more efficient than row-based units alone.

Figure 78 illustrates the layout of a typical installation with two rows of racks and Liebert XDV™ modules. Two Liebert CRV units are used to support the Liebert XD system and provide N+1 redundant humidity control.

Figure 78 Liebert CRV placement with Liebert XDV's



Refer to the Liebert XD System Design manual, SL-16655, for details on configuring a Liebert XD unit for use with a Liebert CRV.

APPENDIX B - EXTRA AIRFLOW—STANDARD ON 600 SERIES, CONFIGURABLE ON 300 SERIES

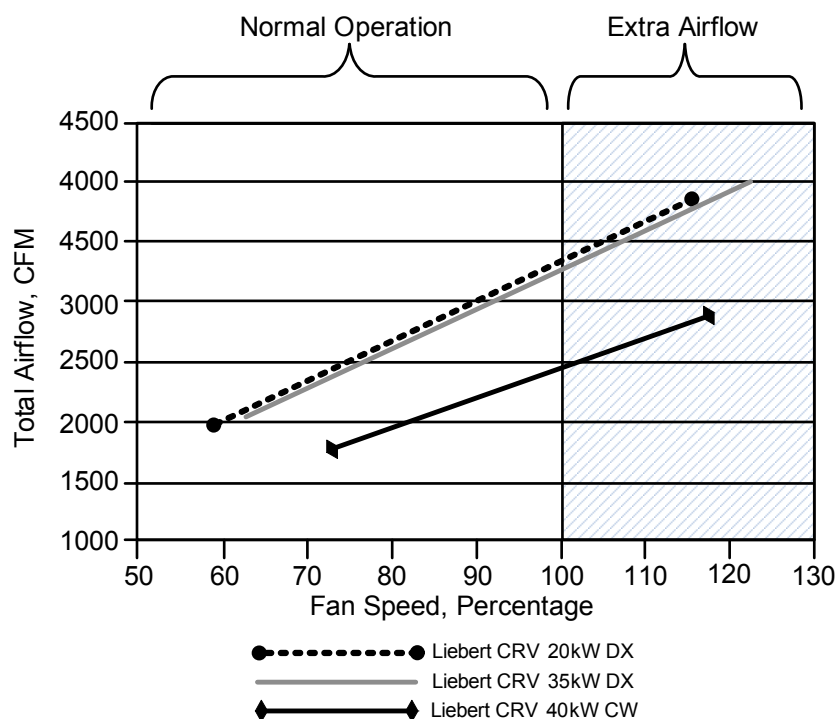
The Liebert CRV has the capability of providing additional airflow to correct for lower density air at higher elevations and during emergency conditions. The Liebert CRV catalog cooling capacity is based on 100% fan speed. During normal operation, the Liebert CRV will automatically modulate its airflow and cooling capacity to satisfy the aisle's requirements. The unit will automatically increase the fan speed above 100% during the following conditions:

- In the event that one of the two fans fail, the functioning fan will increase to maximum speed to help compensate for the lost airflow. The unit will automatically modulate its cooling capacity to avoid undesirable conditions if necessary (coil freezing and high/low refrigerant head pressure conditions).
- If a different Liebert CRV experiences a problem that requires help from other nearby Liebert CRV's, the healthy units will automatically increase their fan speed above 100% to provide additional airflow and/or cooling (requires Liebert iCOM® unit-to-unit Teamwork communication).
- A room can become extremely hot during a power failure when heat-generating server equipment continues to run on backup power while air conditioners are without power. The Liebert CRV will automatically utilize its extra airflow if a room is extremely hot after a power outage to cool the room back to setpoint as fast as possible.

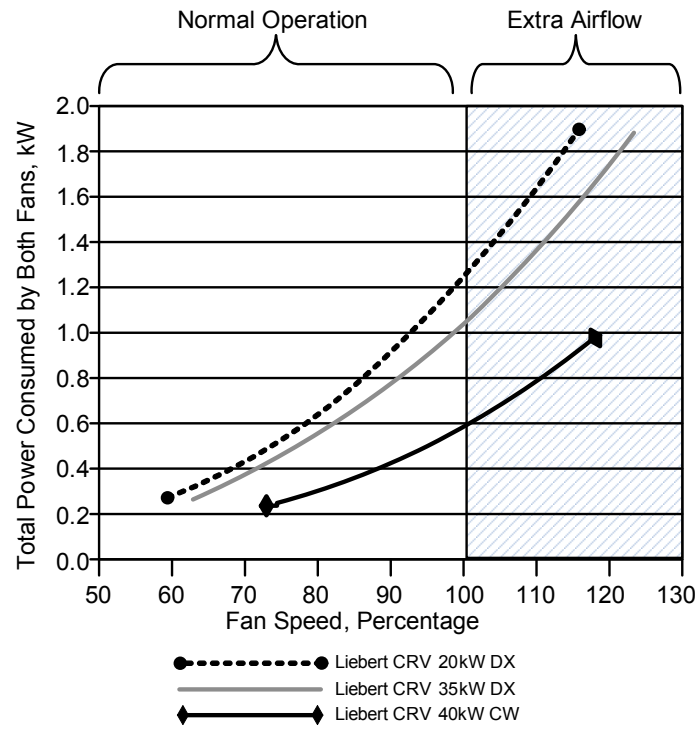
Table 54 Nominal Airflow

Liebert CRV Model	Catalog Rating 100% Fan Speed (CFM)	Maximum Fan Speed (CFM)	Extra Airflow
CRV 20kW DX	2455	2890	18%
CRV 35kW DX	3260	4005	23%
CRV 40kW CW	3325	3855	16%

Figure 79 Nominal Airflow



Since the fans are spinning at partial speed during normal operating conditions, the energy consumption is much lower than the nameplate rating of the motors. This provides the same energy saving benefits of using smaller size fans without the risk of running short on airflow.

Figure 80 Nominal Energy Consumption of Both Fans

APPENDIX C - SEISMIC APPLICATION, 600MM (24") MODELS—OPTIONAL UNIT CONFIGURATION REQUIRED

Source: DPN002765, Rev. 1

Emerson Network Power has conducted analytical modeling and dynamic shake table testing of the Liebert CRV 600mm to provide an option for seismic certification of compliance with the International Building Code (IBC) code for design and installation of building systems. This certification goes beyond the equipment's ability to withstand forces in a seismic event. The IBC approach includes the equipment, equipment anchorage and connections to the equipment: power, water supply and return and ducting. In critical applications, the equipment must be capable of performing its primary function after a seismic event within the limits of certification.

C.1 SEISMIC CERTIFICATION CRITERIA

The Liebert CRV 600mm (24") model has two levels of certification for units attached to the floor without spring isolators. Both levels require unit mounting bracket as shown in Detail A in **Figures 86** and **87**. The CRV600 is approved for seismic applications when properly installed and used as intended and located in United

States where the "design 5 percent damped spectral response acceleration at short periods adjusted for site class effects" S_{DS} is as shown in **Tables 55** and **56**. Below grade, at grade or above grade installations are permitted and included in this approval. This certification is good for an I_p of 1.0 or 1.5.

The first level is $S_{DS}=0.8$ which is the standard unit (rigid mount only; no floor stand).

Table 55 Shake table test parameters, first level

Text Criteria ICC-ES AC 156	S_{DS} (g)	z/h	A_{FLX}	A_{RIG}	A_{FLX_VERT}	A_{RIG_VERT}
Rigid Mount	0.8	1.0	1.28	0.96	0.54	0.22

Equipment is qualified for S_{DS} and z/h values shown. Qualification may be valid for higher S_{DS} where z/h < 1.0.

The second level for $S_{DS}=2.00/2.50$ requires factory-installed bracing (rigid or floor stand mount).

Table 56 Shake table test parameters, second level

Text Criteria ICC-ES AC 156	S_{DS} (g)	z/h	A_{FLX}	A_{RIG}	A_{FLX_VERT}	A_{RIG_VERT}
Rigid Base Mount or Floor Stand	2.00	1.0	3.20	2.40	—	—
	2.50	0	—	—	1.68	0.68

Equipment is qualified for S_{DS} and z/h values shown. Qualification may be valid for varying S_{DS} where z/h < 1.0.

C.2 ANCHORAGE REQUIREMENTS

Anchors—Mounting requirement details such as brand, type, embedment depth, edge spacing, anchor spacing, concrete strength, wall bracing and special inspection must be outlined and approved by the project structural engineer of record.

Anchorage Surface—Structural floors and housekeeping pads must also be seismically designed and approved by the project structural engineer of record to withstand the seismic anchor loads as defined on the installation drawings. The installing contractor is responsible for the proper installation of all anchors and mounting hardware, observing the mounting requirement details outlined by the Engineer of Record. Contact the manufacturer's representative if a detailed seismic installation calculation package is required.

Connections to Unit—Electrical wiring, conduit and other connections to the equipment is the responsibility of others. Data and recommendations are supplied here and in the unit installation supplement for seismic installation.

Figure 81 Seismic anchorage rigid floor stand dimensions

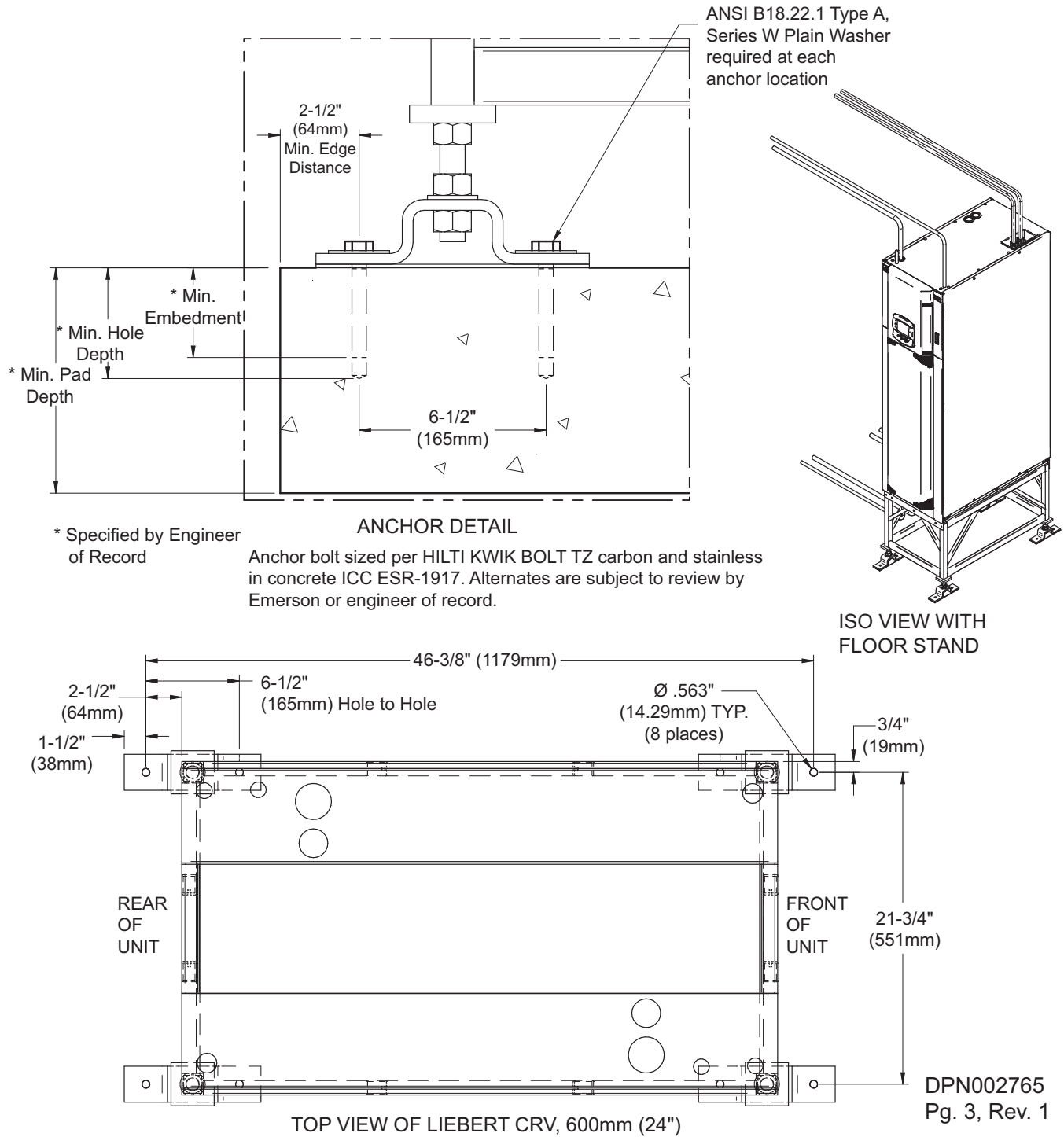


Figure 82 Seismic floor anchorage dimensions

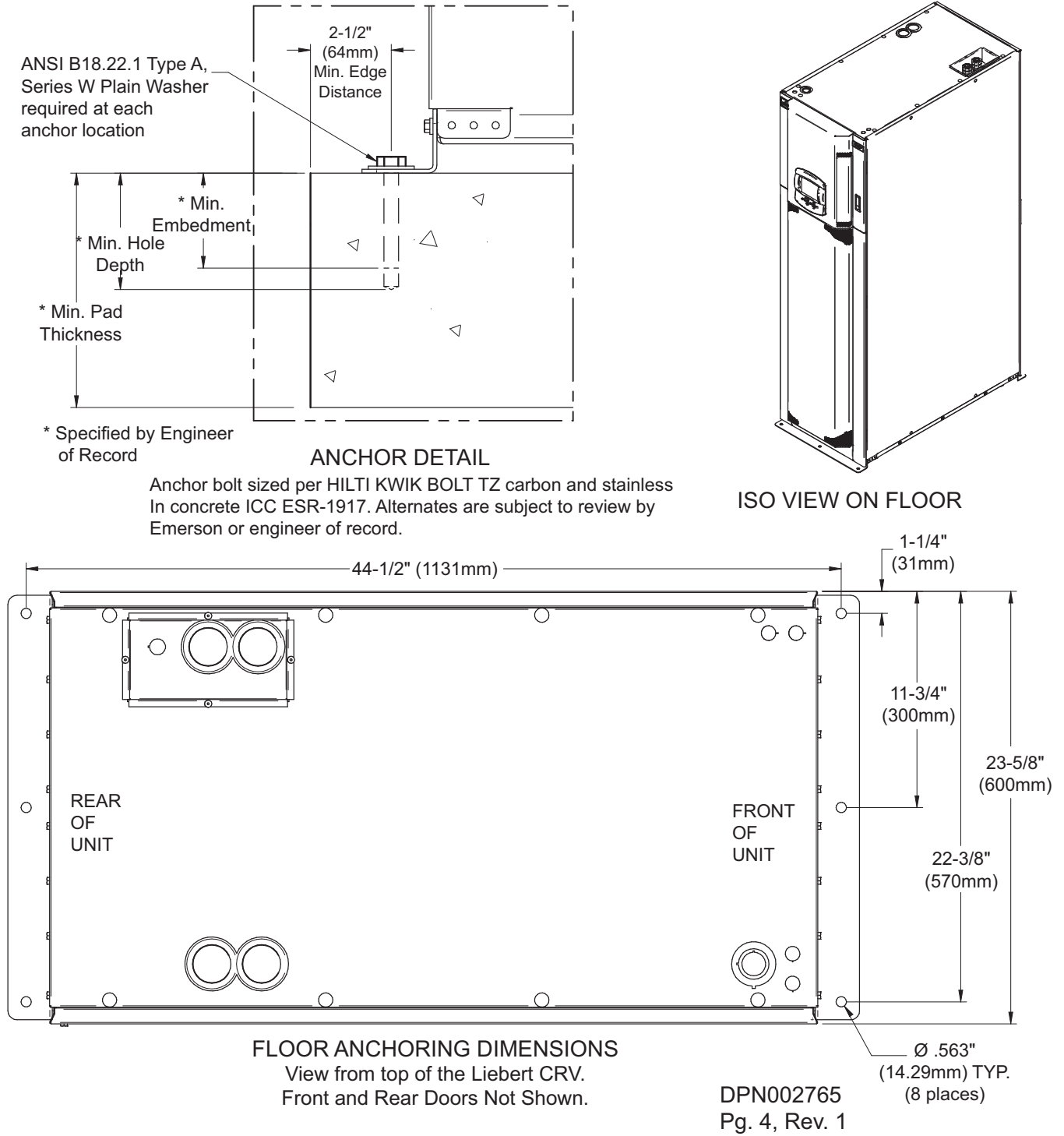
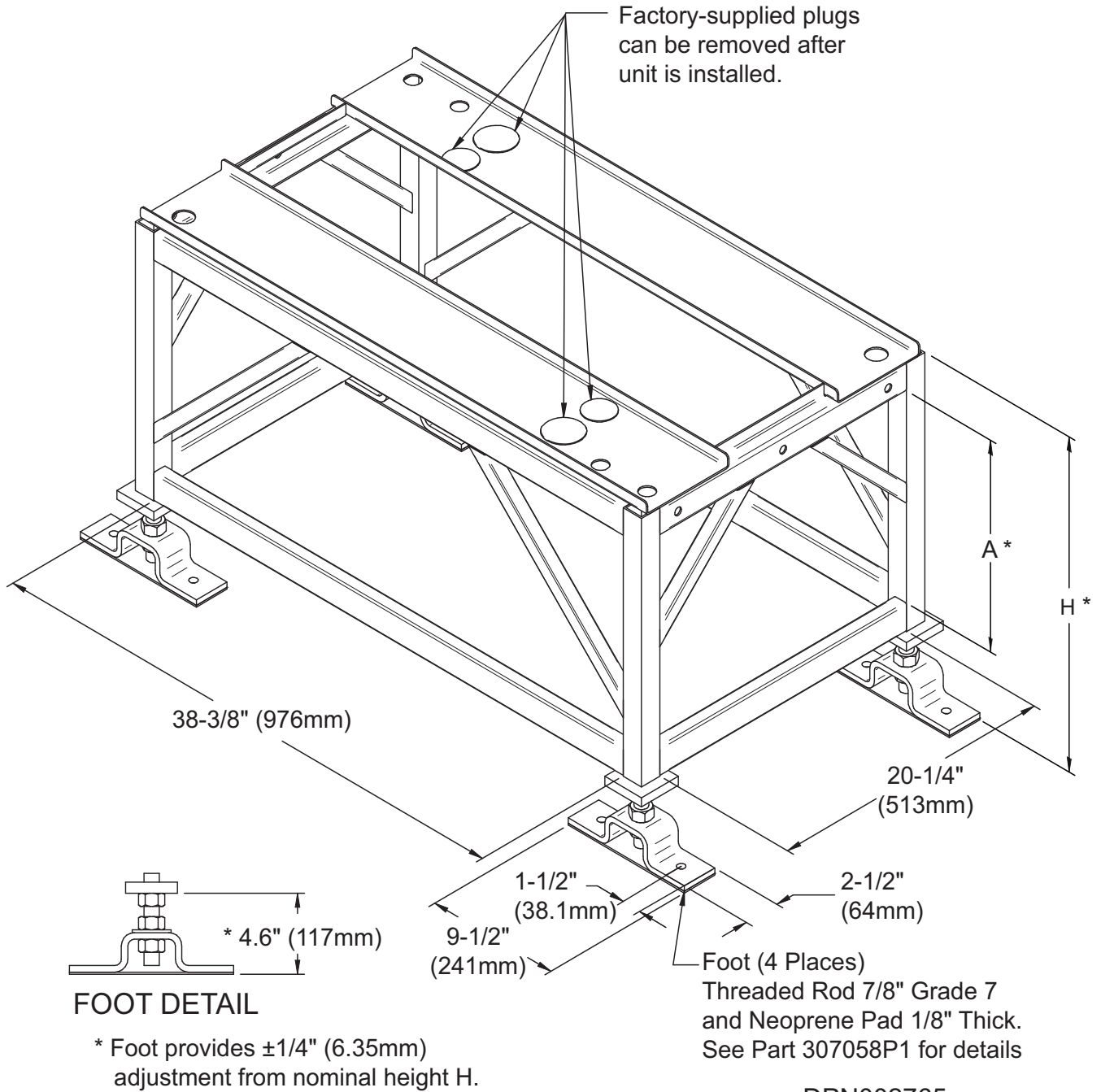


Figure 83 Floor stand overall dimensions

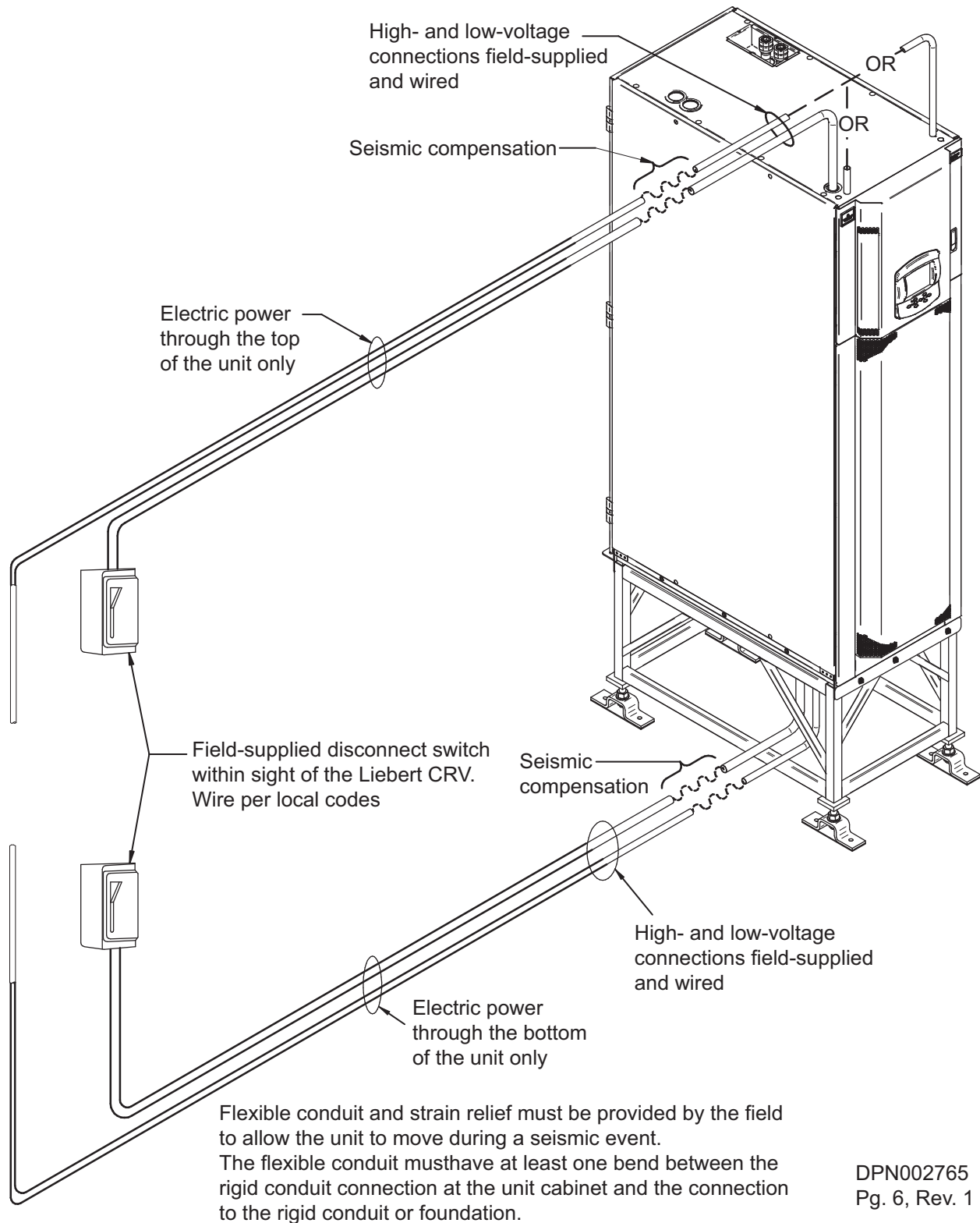


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Table 57 Dimensions in Figure 83

* Nominal	A in (mm)	H* in (mm)
12	12 (305)	8-3/4 (222)
18	18 (457)	14-3/4 (375)
24	24 (610)	20-3/4 (527)

Figure 84 Seismic electrical wiring



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Figure 85 Seismic piping

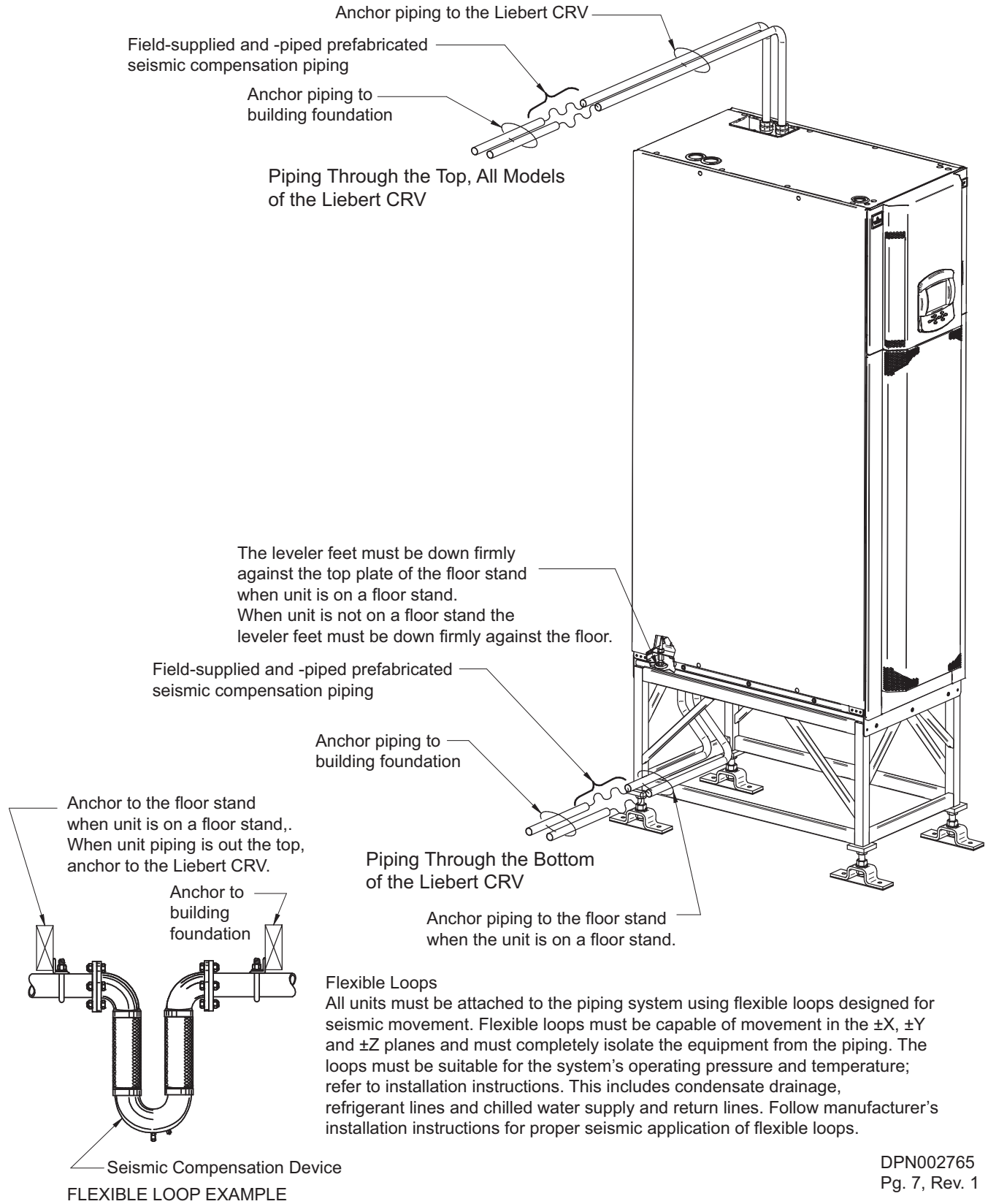


Figure 86 Seismic certification tested connection detail

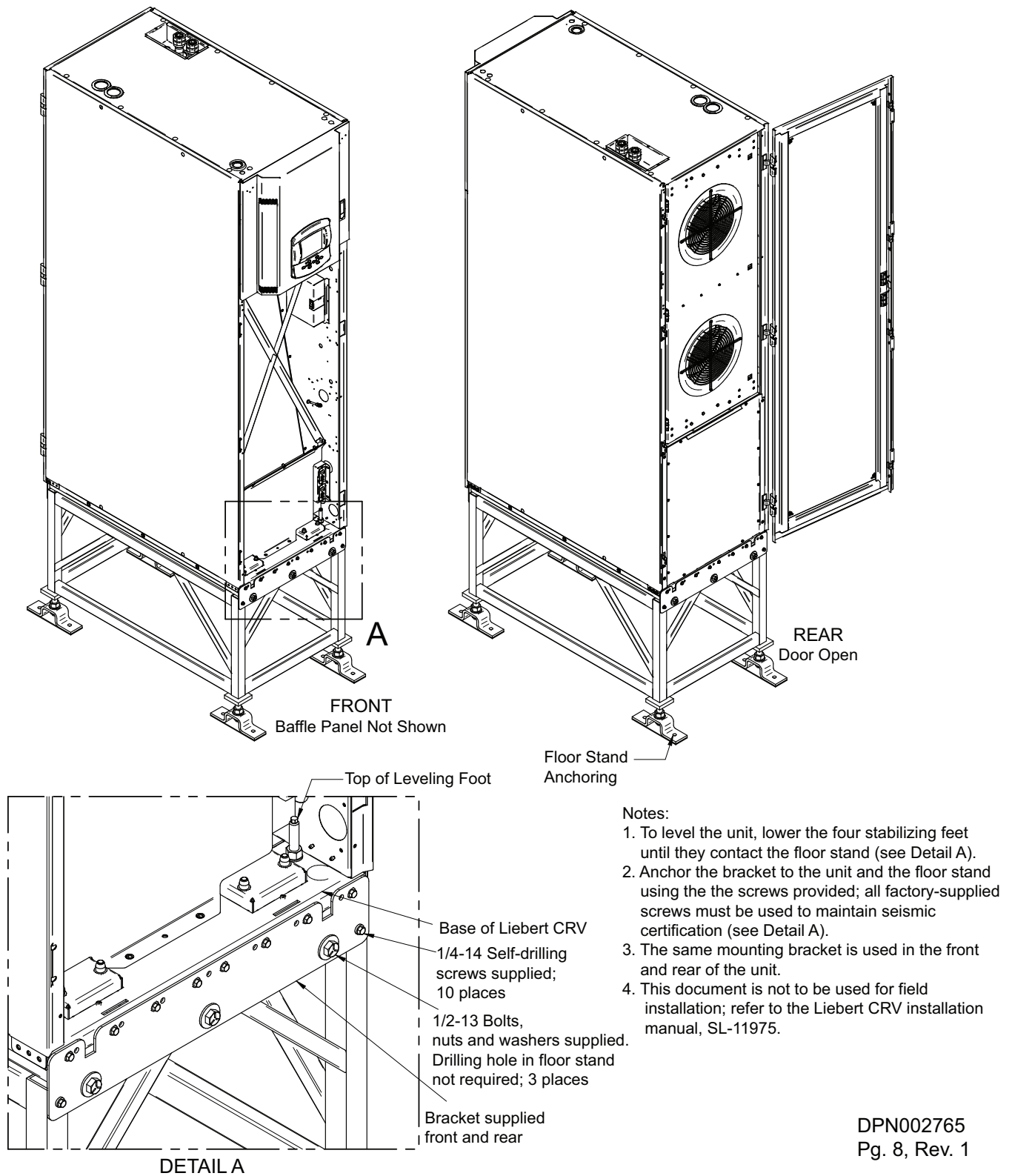
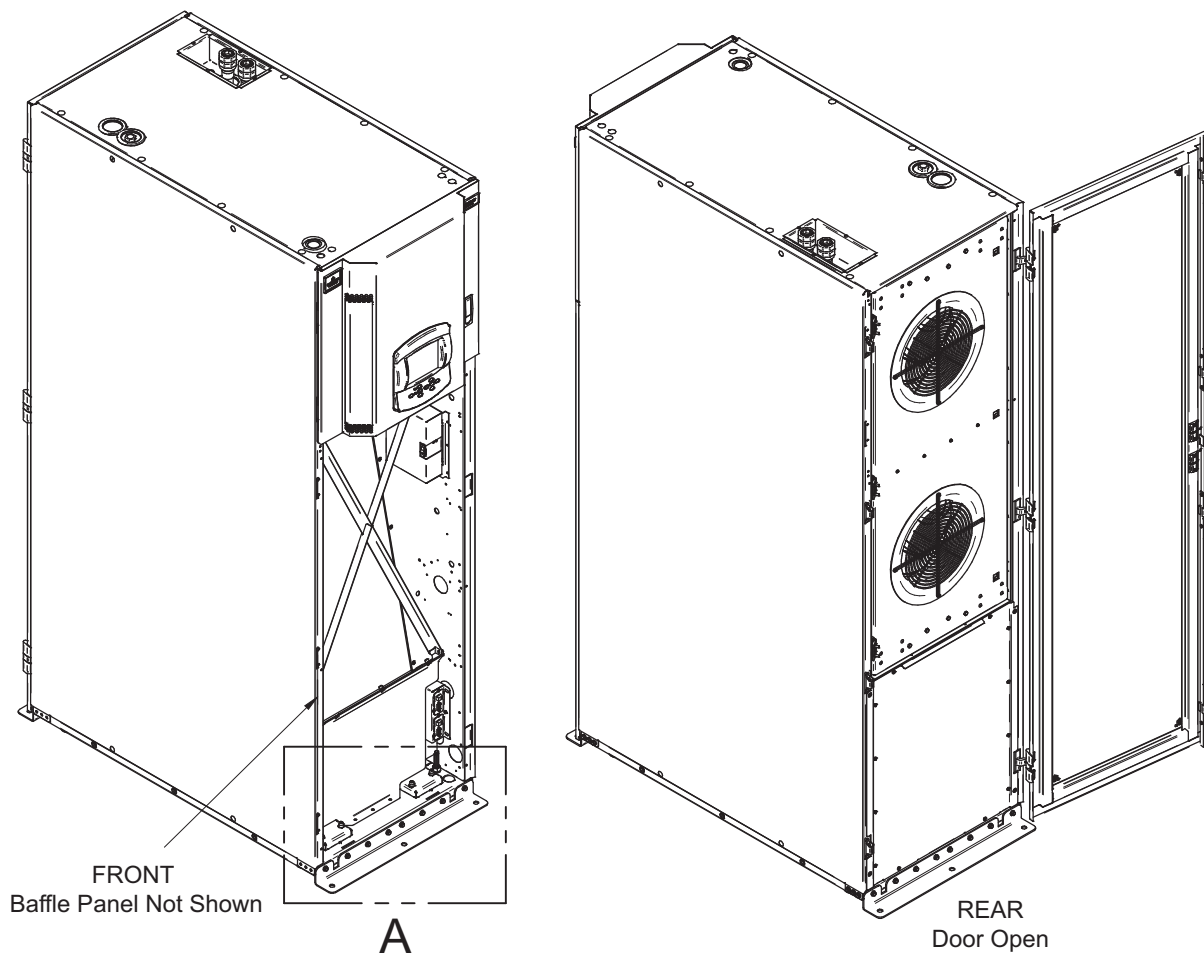
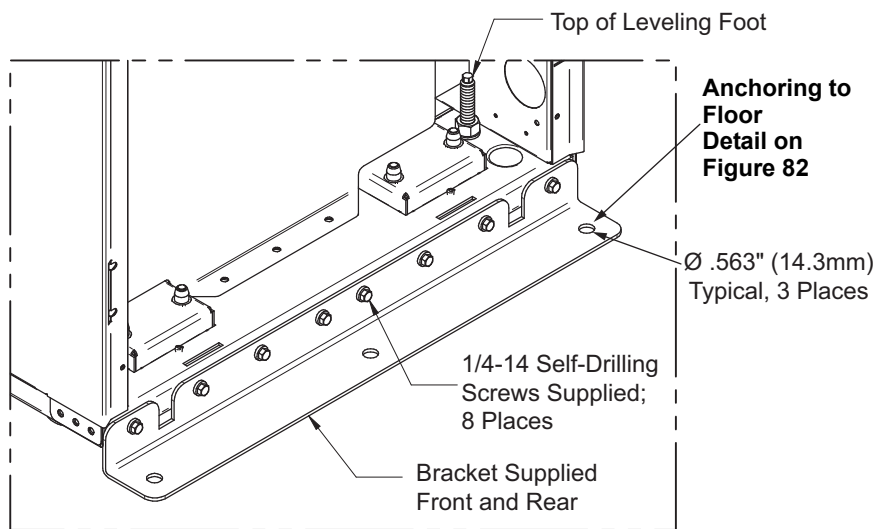


Figure 87 Seismic certification tested connection detail (continued)



1. Lower the four leveling feet until they contact the floor before attaching the bracket (see Detail B). Verify that the unit is level to avoid corrosion and health hazards caused by condensate accumulation.
2. Bracket must be centered on the Liebert CRV's base (see Detail A).
3. Anchor the bracket to the floor. Refer to the anchoring detail on **Figure 82**.
4. Self-drilling screws (see Detail A) to secure the bracket to the Liebert CRV.
5. The bracket is also used in the rear of the Liebert CRV.
6. This document is not to be used for field installation.



DETAIL A
Front of Liebert CRV

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Figure 88 Rigid floor mount bracket dimensions

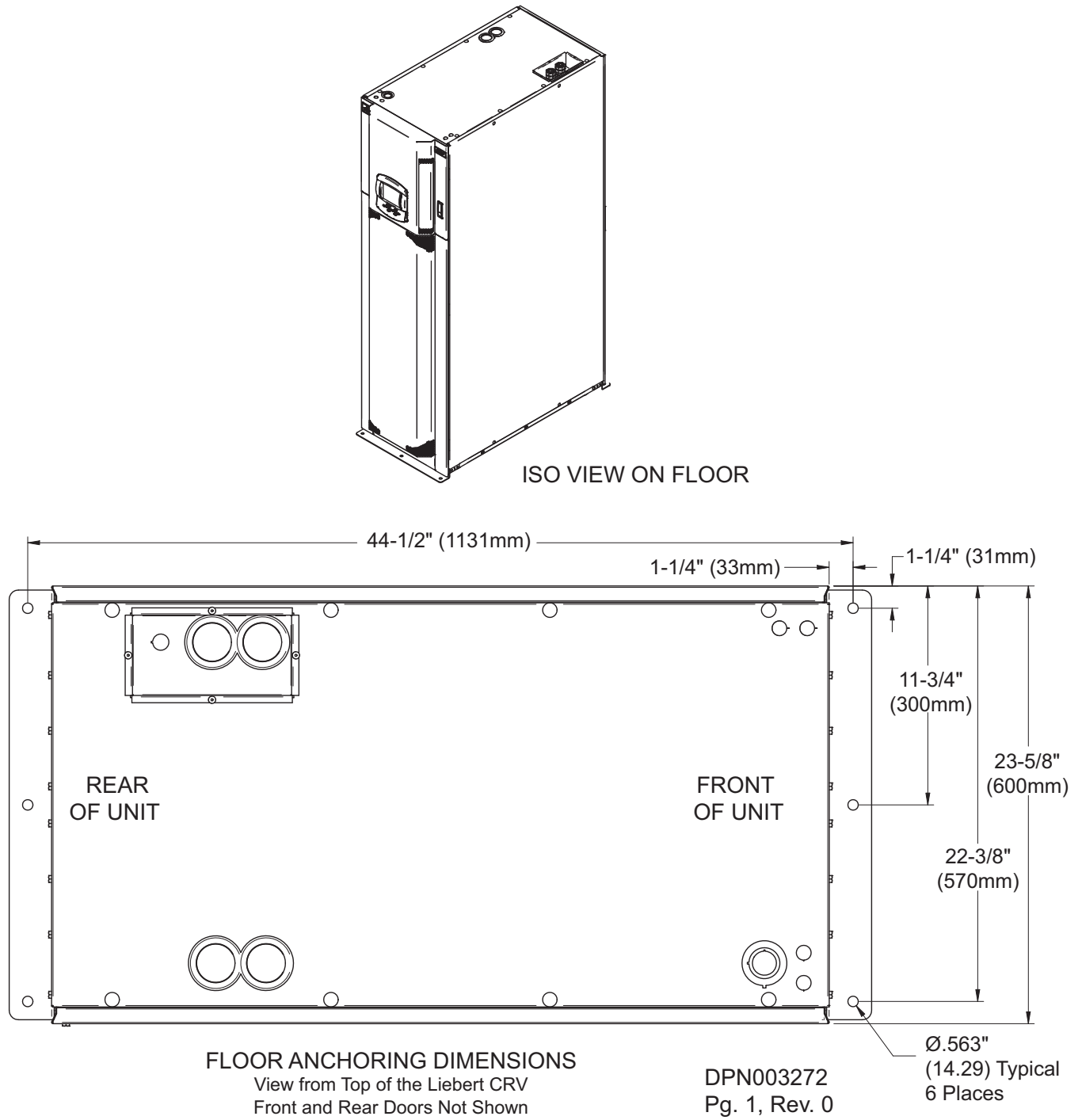


Figure 89 Rigid floor mount bracket connection details

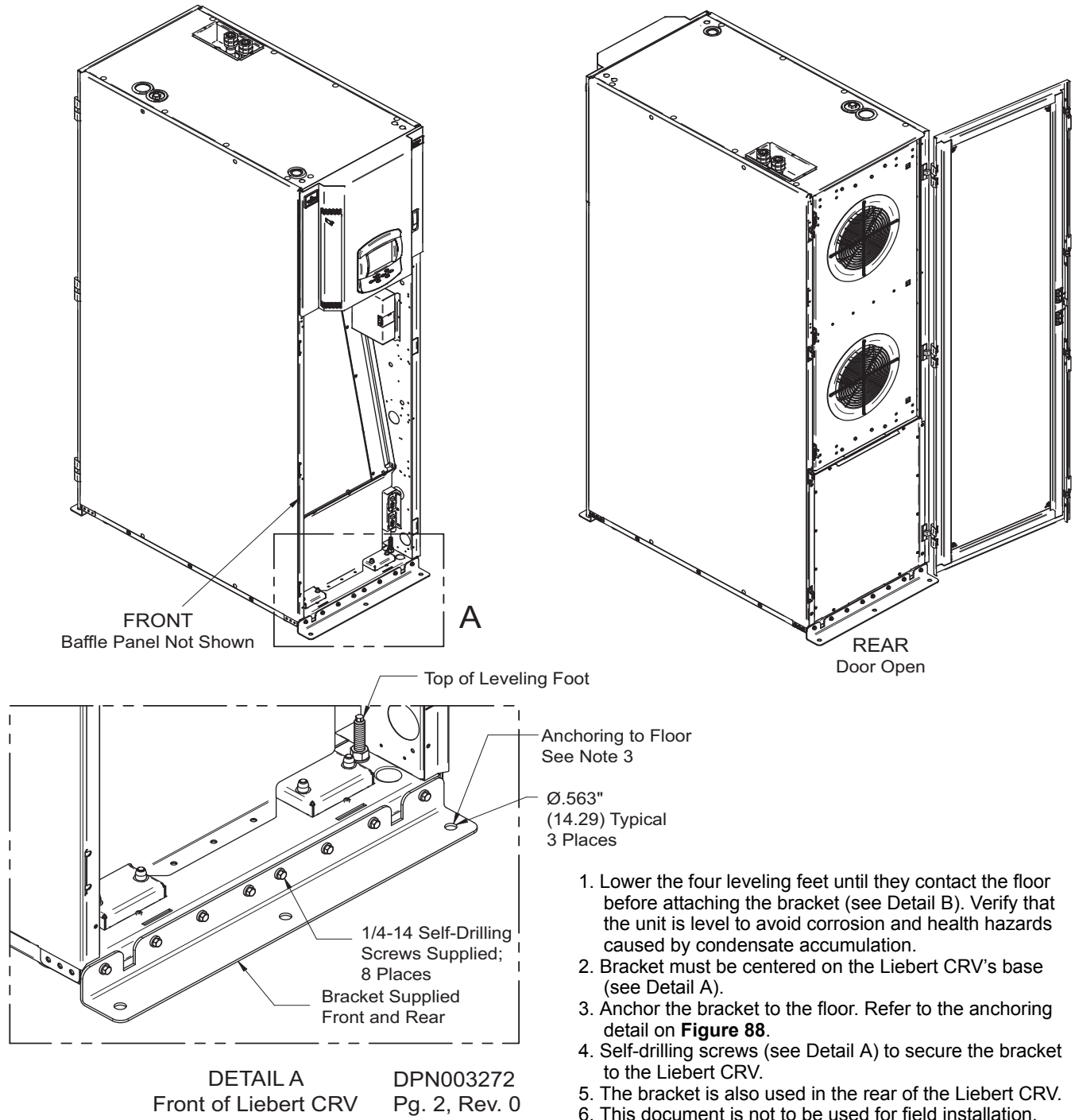


Figure 90 Floor stand dimensions—Top view

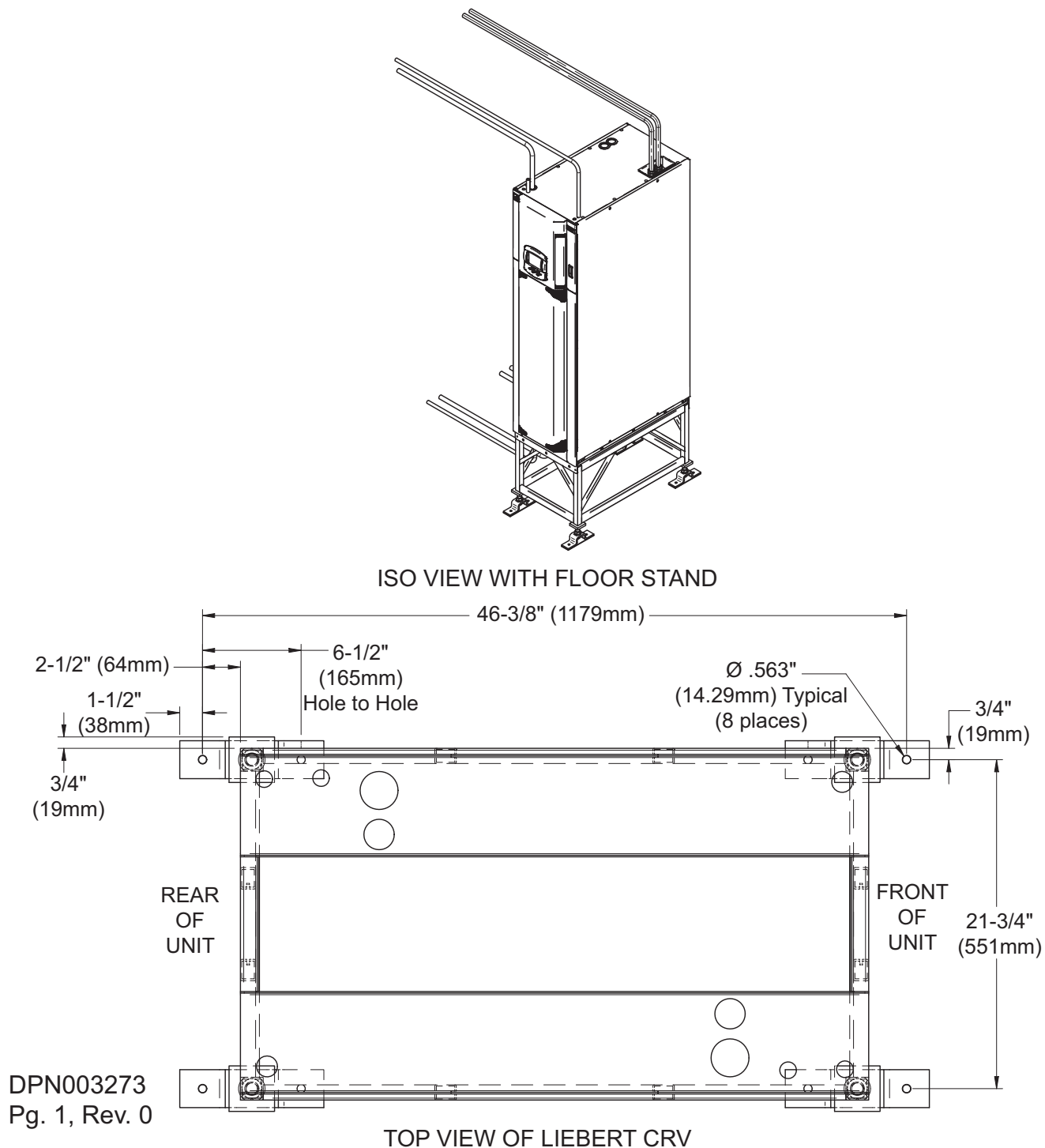
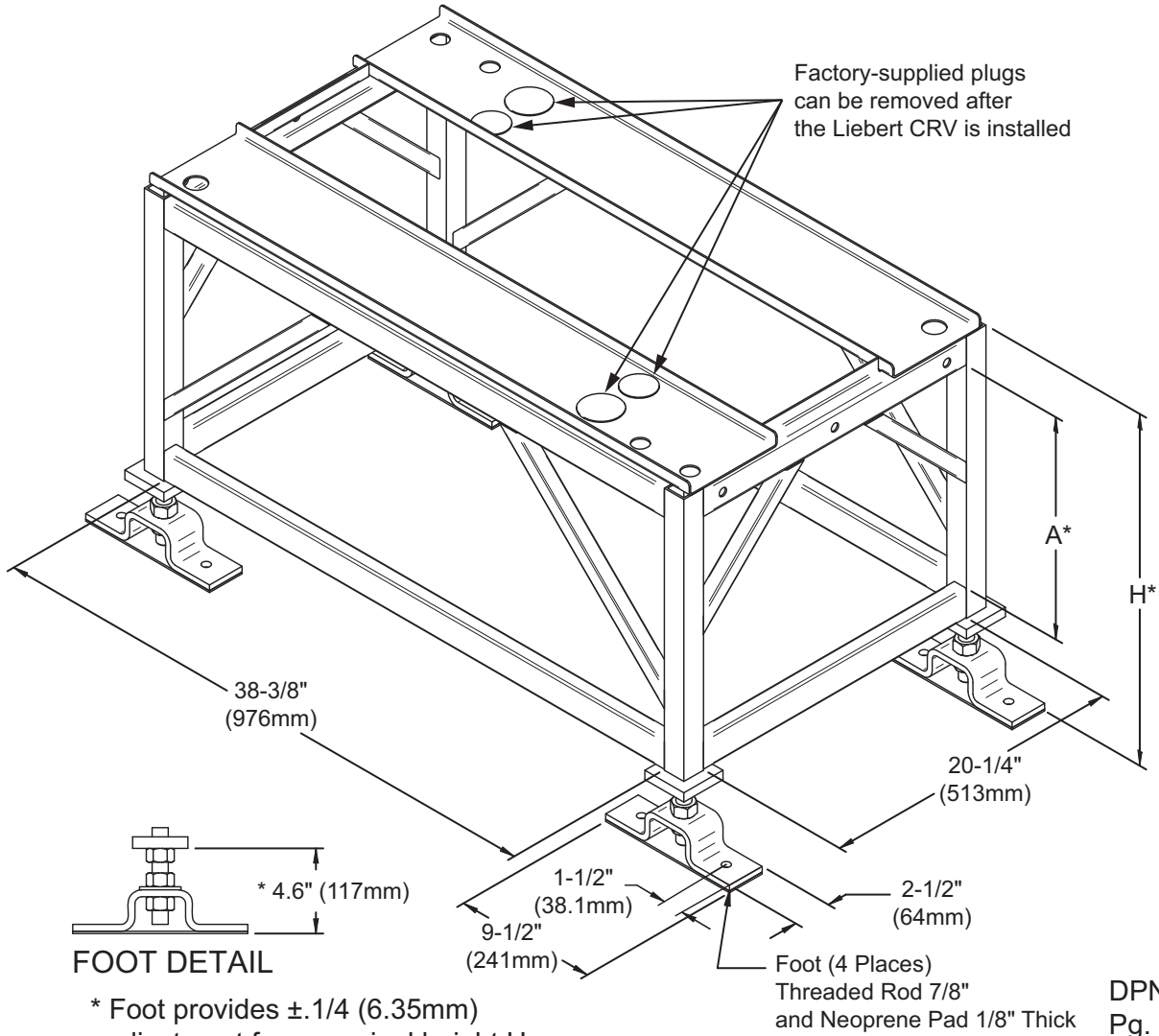


Figure 91 Floor stand overall dimensions

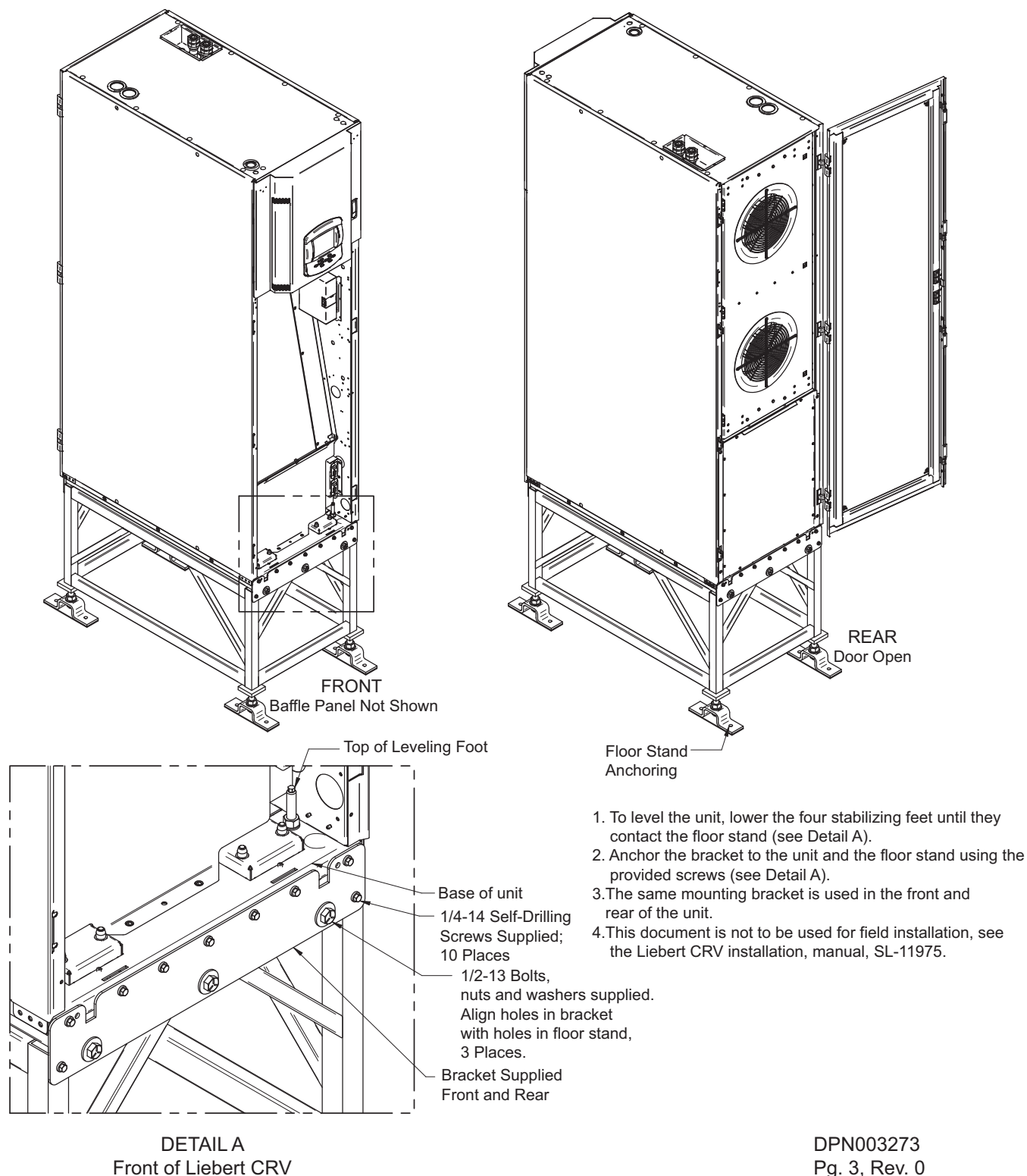


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Pg. 2, Rev. 0

Table 58 Dimensions in Figure 91

* Nominal	A in (mm)	H* in (mm)
12	12 (305)	8-3/4 (222)
18	18 (457)	14-3/4 (375)
24	24 (610)	20-3/4 (527)

Figure 92 Floor stand connection details



APPENDIX D - GUIDE SPECIFICATIONS—ROW-BASED ENVIRONMENTAL CONTROL SYSTEM

1.0 GENERAL

1.1 Summary

These specifications describe requirements for a mission critical environmental control system. The system shall be designed to control temperature and humidity conditions in rooms containing electronic equipment, with good insulation and vapor barrier. The manufacturer shall design and furnish all equipment to be fully compatible with the heat dissipation requirements of the room.

1.2 Design Requirements

The precision environmental control system shall be a self-contained, factory-assembled Liebert unit with horizontal airflow delivery. Standard 60Hz units shall be CSA (NRTL-C) certified.

The air-cooled condenser shall be a factory-assembled unit, complete with integral electrical panel, designed for outdoor installation. The condenser shall be a draw-through design.

The condenser shall have a total heat rejection capacity of _____ kW (kBtuh) rated at an outdoor ambient of ____ °F (°C) and a midpoint condensing temperature of _____ °F (°C) and a refrigerant flow to produce a subcooling of 5°F (2.8°C).

The unit shall be supplied for operation using a _____ volt _____ phase, _____ Hz power supply.

1.3 Submittals

Submittals shall be provided with the proposal and shall include: Single-Line Diagrams; Dimensional, Electrical, and Capacity Data; Piping and Electrical Connection Drawings.

2.0 PRODUCT

2.1 Cooling System

2.1.1 Air-Cooled Refrigeration System

2.1.1.1 Refrigeration System

The single refrigeration circuit shall include a liquid line filter drier, a refrigerant sight glass with moisture indicator, an adjustable, externally equalized expansion valve and a liquid line solenoid valve. The indoor evaporator refrigerant piping shall be spun shut with a nitrogen holding charge. Field relief of the Schrader valve shall indicate a leak-free system.

2.1.1.2 Hydrophilic-Coated Evaporator Coil

Models CR020, CR035

The direct expansion, tilted-slab cooling coil shall have 7.25 ft² (0.674 m²) face area, four or five rows deep. It shall be constructed of copper tubes and hydrophilic-coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. Two stainless steel condensate drain pans shall be provided.

Model CR019

The direct expansion, slab cooling coil shall have 6.2ft² (0.576 m²) face area, three rows deep. It shall be constructed of copper tubes and hydrophilic-coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. One stainless steel condensate drain pan shall be provided.

2.1.1.3 Compressor

The compressor shall be scroll-type with variable capacity operation from 20-100%, commonly known as a *digital scroll*. The compressor solenoid valve shall unload the compressor to provide variable capacity operation. The compressor shall have a suction gas-cooled motor, vibration isolators, internal thermal overloads, manual reset high-pressure switch, rotalock service valves, low-pressure and high-pressure transducer, crankcase heater, internal centrifugal oil pump and an operating speed of 3500 rpm at 60Hz (2900rpm @ 50Hz). The compressor shall be located outside the airstream and shall be removable and serviceable from the rear of the unit.

2.1.1.4 R410A Refrigerant

The system shall be designed for use with R410A refrigerant, which meets the U.S. Clean Air Act for phaseout of HCFC refrigerants.

2.1.1.5 Low Noise Package

The Low Noise Package shall reduce the level of sound emitted from the compressor. The package shall consist of a 3/8 inch closed cell polymeric 4.5 - 8.5 lb/ft³ density compressor sound jacket that encloses the compressor. Additional half-inch, closed cell polymeric 3 - 8 lb/ft³ density sound deadening material shall be affixed to the underside of the Superior Service Access Panel located above the compressor and attached to the inner side of the compressor compartment panels that face the hot and cold aisles. All sound deadening material shall be non-shedding and located outside the airstream.

2.1.2 Water/Glycol-Cooled Refrigeration System

2.1.2.1 Refrigeration System

The single refrigeration circuit shall include a liquid line filter drier, an adjustable externally equalized expansion valve and a liquid line solenoid valve. The water/glycol circuit shall be equipped with an insulated, brazed-plate heat exchanger having a total pressure drop of _____ ft. (kPa) of water at a flow rate of _____ GPM (l/s) with _____ °F (°C) entering water/glycol temperature. The water piping shall be threaded closed with a nitrogen holding charge. Field-relief of the Schrader valve shall indicate a leak-free system.

2.1.2.2 Hydrophilic-Coated Evaporator Coil

Models CR020, CR035

The direct expansion, tilted-slab cooling coil shall have 7.25 ft² (0.674 m²) face area, four or five rows deep. It shall be constructed of copper tubes and hydrophilic-coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. Two stainless steel condensate drain pans shall be provided.

Model CR019

The direct expansion, slab cooling coil shall have 6.2ft² (0.576 m²) face area, three rows deep. It shall be constructed of copper tubes and hydrophilic-coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. One stainless steel condensate drain pan shall be provided.

2.1.2.3 Compressor

The compressor shall be scroll-type with variable capacity operation from 20-100%; commonly known as a *digital scroll*. Compressor solenoid valve shall unload the compressor to provide variable capacity operation. The compressor shall have a suction gas-cooled motor, vibration isolators, internal thermal overloads, manual reset high-pressure switch, rotalock service valves, low-pressure and high-pressure transducer, crankcase heater, internal centrifugal oil pump and an operating speed of 3500 rpm at 60Hz (2900rpm @ 50Hz). The compressor shall be located outside the airstream and shall be removable and serviceable from the rear of the unit.

2.1.2.4 R410A Refrigerant

The system shall be designed for use with R410A refrigerant, which meets the U.S. Clean Air Act for phaseout of HCFC refrigerants.

2.1.2.5 Low Noise Package

The Low Noise Package shall reduce the level of sound emitted from the compressor. The package shall consist of a 3/8-inch, closed-cell polymeric 4.5 - 8.5 lb/ft³ density compressor sound jacket that encloses the compressor. Additional half-inch, closed-cell polymeric 3 - 8 lb/ft³ density sound deadening material shall be affixed to the underside of the Superior Service Access Panel located above the compressor and attached to the inner side of the compressor compartment panels that face the hot and cold aisles. All sound deadening material shall be non-shedding and located outside the airstream.

2.1.2.6 Modulating Valve

Two-Way

A two-way modulating valve shall control the water/glycol flow through the insulated, brazed-plate condenser. The Liebert iCOM[®] shall manage the valve actuator movement to maintain the desired condensing temperature for various entering water temperatures. The maximum differential pressure across the closed valve shall be 43.5 PSI (300 kPa). Maximum system pressure shall be 230PSI (1,586 kPa).

Three-Way

A three-way modulating valve shall control the water/glycol flow through the insulated, brazed-plate condenser. The Liebert iCOM[®] shall manage the valve actuator movement to maintain the desired condensing temperature for various entering water temperatures. The maximum differential pressure across the closed valve shall be 43.5 PSI (300 kPa). Maximum system pressure shall be 230PSI (1586 kPa).

2.1.2.7 Brazed-Plate Heat Exchanger

The heat exchanger shall be an insulated, brazed-plate type. The primary side shall be piped to a chilled water source, and the secondary side shall be connected to the refrigeration system. A strainer must be installed upstream of the Liebert CRV, on the primary (building) chilled water side.

2.1.3 Chilled Water System

The water circuit shall be designed to distribute water into the entire coil face area.

2.1.3.1 Hydrophilic-Coated Evaporator Coil

Model CR040

The chilled water tilted-slab cooling coil shall be 7.25 ft² (0.674m²) face area, six rows deep. It shall be constructed of copper tubes and hydrophilic-coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. Two stainless steel condensate drain pans shall be provided. The water circuit shall be threaded shut with a nitrogen holding charge. Field-relief of the Schrader valve shall indicate a leak-free system.

Model CR032

The chilled water, rotated slab cooling coil shall be three rows deep with the 32kW model having 7.8ft² (0.72m²) of face area. It shall be constructed of copper tubes and hydrophilic-coated aluminum fins. The hydrophilic coating shall significantly improve the speed of condensate drainage from the fins and shall provide superior water carryover resistance. A stainless steel condensate drain pan shall be provided. The water circuit shall be threaded shut with a nitrogen holding charge. Field-relief of the Schrader valve shall indicate a leak-free system.

2.1.3.2 Modulating Valve

Two-Way Valve

A two-way modulating valve shall control the chilled water flow through the cooling coil. The Liebert iCOM® shall manage the valve actuator movement to provide the desired amount of cooling for various entering water temperatures. Cooling capacity shall be regulated by varying the chilled water flow. The maximum differential pressure across the closed valve shall be 200 PSI (1379 kPa). Maximum system pressure shall be 325PSI (2,241 kPa).

Three-Way Valve

A three-way modulating valve shall control the chilled water flow passing through the cooling coil. The Liebert iCOM® control shall manage the valve actuator movement in order to provide the desired amount of cooling for various entering water temperatures. Cooling capacity shall be regulated by varying the chilled water flow. The maximum differential pressure across the closed valve shall be 200 PSI (1,379 kPa). Maximum system pressure shall be 325PSI (2,241 kPa).

2.2 Fan Section

Models CR020, CR035, CR040

The unit shall be equipped with two plug fans: direct-driven centrifugal fans with backward-curved blades and electronically commutated DC motors; commonly referred to as *EC plug fans*. The fan speed shall be variable and automatically regulated by the Liebert iCOM® through all modes of operation. Each fan shall have a dedicated motor, fault monitoring circuitry and speed controller which provides a level of redundancy. Both impellers shall be made of steel and balanced. The EC plug fans shall be mounted on the rear door. The entire fan assembly shall be capable of swinging out of the unit for accessibility. The fans shall be located to blow air through the filters and tilted-slab cooling coil to ensure even air distribution and maximum coil performance.

Model CR019

The unit shall be equipped with five plug fans: direct-driven centrifugal fans with backward-curved blades and electronically commutated DC motors; commonly referred to as *EC plug fans*. The fan speed shall be variable and automatically regulated by the Liebert iCOM through all modes of operation. Each fan shall have a dedicated motor, fault monitoring circuitry and speed controller, which provides a level of redundancy. Both impellers shall be made of steel and balanced. The EC plug fans shall be mounted in the front of the unit and draw air through the coil.

Model CR032

The unit shall be equipped with six plug fans: direct-driven centrifugal fans with backward-curved blades and electronically commutated DC motors; commonly referred to as *EC plug fans*. The fan speed shall be variable and automatically regulated by the Liebert iCOM through all modes of operation. Each fan shall have a dedicated motor, fault monitoring circuitry and speed controller, which provides a level of redundancy. Both impellers shall be made of steel and balanced. The EC plug fans shall be mounted in the front of the unit and draw air through the coil.

2.3 Advanced Airflow Management

2.3.0.1 Supply Air Baffle System

Models CR020, CR035, CR040

A field-adjustable, modular supply air baffle system shall be located in the discharge airstream on the front of the cabinet to direct air toward the equipment racks and balance airflow requirements within the row. The six modular baffle segments shall be easily reconfigurable to redirect airflow as cooling requirements change. Controlling the airflow prevents hot spots and maintains high return air temperatures by not blowing cold air over racks or out the ends of aisles. By focusing the cold air where it is needed and meeting the servers' requirements, the need for excessive airflow and energy consumption is eliminated.

Models CR019, CR032

A field-adjustable, modular supply air baffle system shall be located in the discharge airstream on the front of the cabinet to direct air toward the equipment racks and balance airflow requirements within the row. The five modular baffle segments shall be easily reconfigurable to redirect airflow as cooling requirements change. Controlling the airflow prevents hot spots and maintains high return air temperatures by not blowing cold air over racks or out the ends of aisles. By focusing the cold air where it is needed and meeting the servers' requirements, the need for excessive airflow and energy consumption is eliminated.

2.4 Cabinet Construction and Accessibility**2.4.1 Cabinet Construction****Models CR020, CR035, CR040**

The exterior panels shall be 20 gauge steel and powder-coated with charcoal color paint to protect against corrosion. The double-wall side panels separate the half-inch, 2.0 lb./ft³ insulation from the airstream and increase unit rigidity. The unit shall be mounted on casters for quick installation and provided with leveling feet. The perforated inlet and outlet panels shall have 81% open area. The rear door shall utilize a Knürr® rack style handle and hinges to mirror the appearance of neighboring server racks.

Model CR019, CR032

The exterior panels of the unit shall be 20 gauge steel and powder-coated with charcoal color paint to protect against corrosion and follow Knürr rack appearance guidelines to mirror the style of neighboring equipment racks. The cabinet shall be mounted on casters for quick installation and provided with leveling feet. Both doors shall have a powder-coated sheet metal frame with hexagonal perforations leaving 81% of the door open to airflow for efficient cooling. The front and rear doors shall swing 170 degrees open, shall be removable and shall feature a two-point latch. The powder-coat painted steel side panels shall be lined with half-inch closed-cell polymeric insulation and secured using quarter-turn fasteners.

2.4.2 Serviceability

The cabinet shall be designed so all components are easily accessible for service and maintenance through either the front or rear of the unit. Units that are not fully accessible from front and rear or not serviceable in place shall be unacceptable.

Models CR020, CR035, CR040

The Superior Service Access Panel shall provide additional access to the top of the system components. Side access shall not be required.

The variable speed EC plug fans shall be mounted on the rear door to provide access to all sides when swung out of the unit. Units with a compressor, dual-float condensate pump and canister humidifier shall have components conveniently mounted near the edge of the unit.

Model CR019, CR032

Side access shall not be required. Each of the variable speed fans shall be individually replaceable through the front door of the unit. Units with a compressor and condensate pump shall be conveniently mounted near the edge of the unit.

2.4.3 Supply Air Baffle System**Models CR020, CR035, CR040**

A field-adjustable, modular supply air baffle system shall be located in the discharge airstream on the front of the cabinet to direct air toward the server racks and balance airflow requirements within the row. The six modular baffle segments shall be easily reconfigurable to redirect airflow as cooling requirements change. Controlling the airflow prevents hot spots and maintains high return air temperatures by not blowing cold air over racks or out the ends of aisles. By focusing the cold air where it is needed and meeting the rack equipment's cooling requirements, the need for excessive airflow and energy consumption is eliminated.

Models CR019, CR032

A field-adjustable, modular supply air baffle system shall be located in the discharge airstream on the front of the cabinet to direct air toward the server racks and balance airflow requirements within the row. The five modular baffle segments shall be easily reconfigurable to redirect airflow as cooling requirements change. Controlling the airflow prevents hot spots and maintains high return air temperatures by not blowing cold air over racks or out the ends of aisles. By focusing the cold air where it is needed and meeting the rack equipment's cooling requirements, the need for excessive airflow and energy consumption is eliminated.

2.5 Locking Disconnect Switch**Models CR020, CR035, CR040**

A manual disconnect switch shall be mounted in the electrical panel and be capable of disrupting the flow of power to the unit. The electric panel compartment shall be accessible only with the switch in the Off position. It shall be located behind the Liebert iCOM® display door for quick access.

Models CR019, CR032

A manual disconnect switch shall be mounted in the electrical panel and be capable of disrupting the flow of power to the unit. The electric panel compartment shall be accessible only with the switch in the Off position. It shall be located behind the rear door for quick access.

2.6 Short Circuit Current Rating (SCCR)**Models CR019, CR020, CR035, CR040**

The electrical panel shall provide at least 65,000A SCCR.

Model CR032 120V/1/60Hz

The electrical panel shall provide at least 5000A SCCR.

Model CR032 208-230/1/60Hz

The electrical panel shall provide at least 65,000A SCCR.

Model CR032 208-230/3/60Hz

The electrical panel shall provide at least 65,000A SCCR.

Model CR032 460/3/60Hz

The electrical panel shall provide at least 65,000A SCCR.

2.7 Filtration**Models CR020, CR035, CR040****MERV 8**

The filter channel shall be an integral part of the system, located within the cabinet and serviceable from the rear. The two filters shall be deep-pleated, 4 inches thick with an ASHRAE 52.2 MERV8 rating (30% ASHRAE 52.1). A filter clog alarm shall be included. Mesh type, cleanable filters shall be unacceptable.

MERV 11

The filter channel shall be an integral part of the system, located within the cabinet and serviceable from the rear. The two filters shall be deep-pleated, 4 inches thick with an ASHRAE 52.2 MERV11 rating (60-65% ASHRAE 52.1). A filter clog alarm shall be included. Mesh type, cleanable filters shall be unacceptable.

Models CR019, CR032**MERV 1**

The two filters shall be an integral part of the system, located within the cabinet and serviceable from the rear. The filters shall be washable, half-inch thick with an ASHRAE 52.2 MERV1 rating. A filter clog alarm shall be included.

MERV 8

The two filters shall be an integral part of the system, located within the cabinet and serviceable from the rear. The filters shall be washable, half-inch thick with an ASHRAE 52.2 MERV8 rating. A filter clog alarm shall be included.

2.7.1 Extra Filter Set (Optional)

_____ extra set(s) of filters shall be provided per system.

2.8 Electric Reheat

The low-watt density, 304/304, stainless steel, finned-tubular electric reheat coils shall be capable of maintaining room dry bulb conditions when the system is calling for dehumidification. The reheat section shall include UL/CSA recognized safety switches to protect the system from overheating. The capacity of the reheat coils shall be controlled in one stage. The reheat elements shall be accessible from the front of the cabinet.

2.9 Steam Generating Canister Humidifier

A canister-type steam generating humidifier shall be factory-installed in the cooling unit and operated by the Liebert iCOM®. It shall be complete with disposable cylinder, all supply and drain valves, steam distributor and electronic controls. The need to change the canister shall be indicated on the Liebert iCOM. The humidifier shall be designed to operate with water conductivity from 330 to 670 (60Hz) microS/cm. The system shall automatically fill and drain as well as maintain the required water level based on conductivity. An air-gap within the humidifier assembly shall prevent back-flow of the humidifier supply water. The humidifier canister shall be removable from the rear of the cabinet.

2.10 Condensate Pump—Models CR020, CR035, CR040

The dual-float condensate pump shall have a minimum capacity of 6 GPM (22.7 l/min) at 30 ft. (9m) head. The pump shall be complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.

2.10 Condensate Pump—Models CR019

The dual-float condensate pump shall have a minimum capacity of 20 GPH (75.7 l/hr) at 16 ft. (4.9m) head. The pump shall be complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.

2.10 Condensate Pump—Models CR032

The dual-float condensate pump shall have a minimum capacity of 45 GPH (171 l/hr) at 13ft (4m) head. The pump shall be complete with integral primary and secondary float switches, pump, motor assembly and reservoir. The secondary float shall send a signal to the local alarm and shut down the unit upon high water condition.

2.11 Liebert iCOM® Microprocessor Control With Large Graphic Display

Small Graphic Display Option shall not be available for Liebert CRV units)

The Liebert iCOM shall be factory-set to allow precise monitoring and control of the rack equipment it is placed near. This control shall include predictive methods to control air flow and cooling capacity based on supply and remote sensors. Proportional and Tunable PID shall also be user-selectable options. Internal unit component control shall include:

- **Compressor Short Cycle Control**—Prevents compressor short-cycling and needless compressor wear.
- **System Auto Restart**—The auto restart feature shall automatically restart the system after a power failure. Time delay shall be programmable.
- **Sequential Load Activation**—On initial startup or restart after power failure, each operational load shall be sequenced with a minimum of one second delay to minimize total inrush current.
- **Predictive Humidity Control**—Calculates the moisture content in the room and prevents unnecessary humidification and dehumidification cycles by responding to changes in dew point temperature.

The Liebert iCOM shall be compatible with all Liebert remote monitoring and control devices. Options are available for BMS interface via Modbus, HTTP, BACnet and SNMP.

The Liebert iCOM shall be microprocessor-based with a 320x240 dot matrix graphic front monitor display and control keys for user inputs and shall be mounted in an ergonomic, aesthetically pleasing housing. The display and housing shall be viewable while the front panel is open or closed. The controls shall be menu driven. The display shall be organized into three main sections: User Menus, Service Menus and Advanced Menus with a secure login for each section. The system shall display user menus for active alarms, event log, graphic data, unit view/status overview (including the monitoring of room conditions, operational status in % of each function, date and time), total run hours, various sensors, display setup and service contacts. A password shall be required to make system changes within the service menus. Service menus shall include setpoints, standby settings (lead/lag), timers/sleep mode, alarm setup, sensor calibration, maintenance/wellness settings, options setup, system/network setup, auxiliary boards and diagnostics/service mode. A password shall be required to access the advanced menus, which include the factory settings and password menus.

The User Menus Shall Be:

- **Active Alarms:** Unit memory shall hold the 200 most recent alarms with time and date stamp for each alarm.
- **Event Log:** Unit memory shall hold the 400 most recent events with ID number, time and date stamp for each event.
- **Graphic Data View:** Two selectable graphic records shall be available from each of the following: return air temperature, return air humidity, dew point, supply air temperature.
- **Unit View-Status Overview:** Simple or Graphical Unit View summary displays shall include temperature and humidity values, active functions (and percent of operation) and any alarms of the host unit.
- **Total Run Hours:** Menu shall display cumulative component operating hours for major components including compressors, Econ-O-Coil (free-cooling), fan motor, humidifier and reheat.
- **Various Sensors:** Menu shall allow setup and display of optional custom sensors.
- **Display Language:** Customer shall be able to select the desired language at the time of order from the following choices: English, French, Italian, Spanish and German.
- **Service Contacts:** Menu shall allow display of local service contact name and phone number.
- **System View-Status Overview:** “System View” shall display a summary of operation for the total number of operating units within a Unit-to-Unit (U2U) configuration.
- **Spare Parts List:** Menu shall include a list of critical spare parts, their quantity and part numbers.
- **Unit Diary:** Menu shall include a free field area within the unit memory where unit history may be stored for reference.

The Service Menus Shall Be:

- **Setpoints:** Menu shall allow setpoints within the following ranges:
 - Temperature Setpoint: 41-104°F (5-40°C)*
 - Temperature Proportional Band: +1-50°F
 - Fan Temperature Setpoint: 41-104°F (5-40°C)*
 - Humidity Setpoint: 20-80% RH*
 - Humidity Sensitivity: 1-30% RH
 - High Temperature Alarm: 35-90°F (2-32°C)
 - Low Temperature Alarm: 35-90°F (2-32°C)
 - High Humidity Alarm: 15-85% RH
 - Low Humidity Alarm: 15-85% RH

* The microprocessor may be set within these ranges; however, the unit may not be able to control to extreme combinations of temperature and humidity.
- **Standby Settings/Lead-Lag:** Menu shall allow planned rotation or emergency rotation of operating and standby units.
- **Alarm Setup:** Menu shall allow customer settings for alarm notification (audible/local/remote). The following alarms shall be available:
 - High Temperature
 - Low Temperature
 - High Humidity
 - Low Humidity
 - Compressor Overload (Optional)
 - Main Fan Overload (Optional)
 - Humidifier Problem
 - High Head Pressure
 - Change Filter
 - Failure
 - Low Suction Pressure
 - Unit Off
- **Audible Alarm:** The audible alarm shall annunciate any alarm that is enabled by the operator.
- **Common Alarm:** A programmable common alarm shall be provided to interface user-selected alarms with a remote alarm device.
- **Remote Monitoring:** All alarms shall be communicated to the Liebert monitoring system with the following information: date and time of occurrence, unit number and present temperature and humidity.
- **Sensor Calibration:** Menu shall allow unit sensors to be calibrated with external sensors.
- **Maintenance/Wellness Settings:** Menu shall allow reporting of potential component problems before they occur.
- **Options Setup:** Menu shall provide operation settings for the installed components.
- **System/Network Setup:** Menu shall allow Unit-to-Unit (U2U) communication and setup for Teamwork modes of operation (up to 32 units).
- **Teamwork Modes of Operation:** Saves energy by preventing multiple units in an area from operating in opposing modes.
- **Diagnostics/Service Mode:** The Liebert iCOM® shall be provided with self-diagnostics to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as On or Off at the front display. Control outputs shall be able to be turned On or Off from the front display without using jumpers or a service terminal. An LED on a circuit board shall indicate each control output.

The Advanced Menus Shall Be:

Factory Settings: Configuration settings shall be factory-set, based on the pre-defined component operation.

Change Passwords: Menu shall allow new passwords to be set or changed.

2.12 Liebert iCOM® Control Methods and Options

Controlling Sensor Options: Liebert iCOM shall be flexible in the sense that it shall allow for controlling the capacity and fan from multiple different sensor selections. The sensor selections shall be:

Cooling Capacity:

- Supply
- Remote
- Return

Fan Speed:

- Supply
- Remote
- Return
- Manual (for diagnostic or to receive a signal from the BMS through the Liebert IS-UNITY™-DP card)

Teamwork Modes of Operation: Liebert iCOM teamwork shall save energy by preventing multiple units in an area from operating in opposing modes. There are three modes of teamwork operation:

- **Teamwork Mode 1:** Allows the control to optimize a group of connected Liebert iCOM units using the U2U. This mode prevents units from operating in opposing modes and ensures efficient cooling and uniform operation.
- **Teamwork Mode 2:** Allows the control to optimize a group of connected Liebert CRV's equipped with Liebert iCOM's using the U2U. The capacity and fan operations in decoupled in this mode, meaning the fan and cooling ramp and respond to the thermal load based on its controlling sensors.
- **Teamwork Mode 3 - Optimized Aisle:** Allows the control to optimize a group of connected Liebert iCOM units using the U2U. The capacity and fan operations in decoupled in this mode, meaning the fan and cooling ramp and respond to the thermal load based on its controlling sensors. In the Optimized Aisle mode, the fans can be controlled by using static pressure (DP or static) with a secondary remote temperature sensor as an override to ensure the inlet rack temperature is being met.

Temperature Compensation: Liebert iCOM shall have the ability to compensate the supply and return setpoints to maintain cooling OR return temperatures to meet cooling needs or SLA guidelines.

Dew Point Control: Liebert iCOM shall have the ability to control the humidity based on dew point to ensure accurate humidity control. This will eliminate needs to dehumidify or humidify based on air temperature when looking at moisture content.

Virtual Back-Draft Damper: Liebert iCOM shall allow the use of a virtual back-draft damper, eliminating the need for a mechanical damper. This shall allow the fans to spin at a low speed (15%) to act as a damper. NOTE: EC fans are needed for this control option.

Cascade: Liebert iCOM cascade option shall allow the units to turn On and Off based on heat load when in Teamwork Mode 1. When utilizing Optimized Aisle, Teamwork Mode 3, the cascading becomes more dynamic as the units coordinate the fan speed to save energy and to meet the cooling demands. For instance, with a Liebert iCOM group of six units and only 50% of the IT capacity the Liebert iCOM shall operate only four units at 80% fan speed and leave the other two units in standby/cascade mode. As the load increases and more equipment is added to the data center, the Liebert iCOM shall automatically respond to the new load and bring on another unit, increasing the units in operation to five. As the load shifts up or down, capacity and server utilization the control shall meet the needs by cascading units On or putting them back into standby.

Virtual Master: As part of the robust architecture of the Liebert iCOM® control, it shall allow for a virtual master that coordinates operation. If for any reason the virtual master becomes disconnected, the control shall shift responsibility to the next unit in the group.

Remote 2T Sensor Sharing: Each Liebert CRV can have up to ten 2T sensors connected and used as a controlling sensor. As part of the U2U network and teamwork, those sensors shall be shared and used to control the units and provide greater flexibility, visibility and control using that to respond to changes in the data center. Those sensors can be as a minimum, maximum or average temperature to control.

Quick Start: Each Liebert CRV unit shall be equipped with a quick start feature that allows the unit to quickly recover from a loss of power.

Global Condenser: Direct expansion Liebert CRV's can be matched to a premium global condenser device that will provide an intelligent communication link. This enables enhanced monitoring and alarming, diagnostics insight, nighttime low noise mode and fan reversal for cleaning mode.

2.13 Rack Temperature Sensors

The Liebert CRV shall be provided with three 2T rack temperature sensors, each consisting of a vented case with two temperature probes. The sensors shall provide real-time, direct feedback to the cooling unit to optimize the amount of cooling and airflow provided. The sensor data shall be available to remote BMS and monitoring systems. The sensor network shall consists of one CAN wire leaving the cooling unit and connecting to a 2T sensor. Each remaining 2T sensor is connected to the previous sensor.

2.13.1 Additional Rack Temperature Sensor(s)

_____ additional 2T rack temperature sensors shall be provided.

2.13.2 Additional CAN Cables for Rack Sensors

_____ additional _____ feet long CAN cables shall be provided.

2.14 Liebert iCOM[®] Wall-Mount Large Graphic Display Liebert vNSA[™] Panel

The Liebert iCOM Large Graphic Display Kit shall include an ergonomic, aesthetically pleasing housing, a 320x240 dot matrix graphical display and a 120V power supply. The wall-mount large graphic display shall be used to allow remote location of a "System View" display and all features of the Large Graphic User, Service and Advanced menus for use with Liebert iCOM-controlled products connected for Unit-to-Unit (U2U) communication.

2.15 Liebert vNSA[™] (Optional)

The Liebert vNSA network switch is designed for connecting multiple Ethernet-ready devices. The unit shall have one or two eight-port switches, providing a total of eight or 16 Ethernet ports. The Liebert vNSA shall have the capability to accept 100-240VAC single-phase input power for proper operation. A universal power supply (12V, 1.5A) shall be installed inside a steel enclosure secured with a key lock with a hard-wired connection for 120V or 230V operation. A Liebert iCOM display shall be mounted on the front. Liebert iCOM shall permit interconnected Liebert CRV units to communicate through two CAT5 or better network patch cables with RJ-45 connectors to connect devices to available ports.

The number of ports available for Ethernet-ready devices varies by the number of eight-port switches included. The Liebert iCOM display provided with the optional Liebert vNSA uses one port for connection to the switch. The 16-port model uses two ports to interconnect the switches.

Model	# Ports	# of Ports Needed to Connect		# Ports Available	Maximum Liebert CRV's that may be connected
		To Liebert iCOM Display	Upper & Lower Switches		
vNSA8-iCOM-CR	8	1	N/A	7	3 Units
vNSA16-iCOM-CR	16	1	2	13	6 Units

2.16 Communication Interfaces

2.16.1 Remote Shutdown Terminal

The remote shutdown terminal shall provide a location to remotely shut down the unit, complying with the National Fire Code.

2.16.2 Common Alarm Contact

The common alarm contact shall provide a set of normally open contacts for remote indication of unit alarms.

2.16.3 Liebert CRV 600mm Cabinet Reheat / Humidifier Lockout

The reheat and humidifier lockout shall include the necessary relays to disable the reheat and humidifier from an external 24V signal while on emergency power.

2.16.4 Liebert CRV 600mm Cabinet (Model 20, 35 and 40) One Extra Common Alarm Contact

One additional contact (total of two sets) of normally open (n/o) contacts for remote indication of unit alarms shall be provided.

2.16.5 Liebert IntelliSlot[®] Unity-DP[™] Card

The Liebert IntelliSlot Unity Card (IS-UNITY-DP) shall provide ground fault isolated RS-485 Modbus, BACnet IP and Modbus IP network connectivity to Building Management Systems for unit monitoring and management. Also, it shall provide ground fault isolated 10/100 baseT Ethernet connectivity for unit monitoring and management. The supported management interfaces include: SNMP for Network Management Systems, HTTP for Web page viewing, SMTP for e-mail and SMS for mobile messaging. The card shall support IP and 485 protocols simultaneously.

2.16.6 Liebert Nform[®] (Optional Advanced Monitoring)

The Critical Infrastructure Management software shall centrally monitor and manage distributed equipment using the customer's existing network infrastructure. The system shall provide the Critical Infrastructure Management and Monitoring for air conditioning (CRAC) systems, uninterruptible power supply (UPS) systems, power distribution units (PDU's), static transfer switches (STS), direct current power systems (DC), power distribution strips (PDU's), Alber[®] battery monitoring, rack enclosure monitoring, leak detection systems and other critical infrastructure systems as specified. The system shall have an architecture that allows up to 10,000 managed devices, including Liebert and third-party devices, in a single-server installation.

2.16.6.1 System Requirements

All material and equipment used shall be standard components, regularly manufactured and available and not custom-designed especially for this project. All systems and components shall have previously been thoroughly tested and proven in actual use before installation on this project.

The manufacturer will furnish or supply a site-specific Critical Infrastructure Management software system based on customer requirements. The system must be a software-only solution; no substitutions shall be accepted.

The system architecture shall consist of network interface cards that shall be installed in all critical infrastructures that, at a minimum, support HTTP and SNMP simultaneously.

The system shall receive SNMP traps from managed equipment and display the alarm notification in a graphical user interface.

The system shall be based on SNMP open protocols and shall integrate seamlessly with Emerson Network Power, Aperture[®] software suite and Network Management Systems.

Open protocol support shall include:

- HTTP(s)
- TCP/IP/v4, TCP/IP/v6
- SNMPv1, SNMPv2

The system shall have the capability of being remotely monitored and managed 24 hours a day, 7 days a week by the manufacturer.

The system shall have the ability to be deployed worldwide.

The system shall operate as a client-to-server application.

The Web interface of each managed device shall integrate directly into the system.

The system shall support enterprise-level databases including Microsoft® SQL™.

The system shall support exporting of all recorded parametric trend data.

The system shall operate on a server determined by the customer. Specific server brand or function is not permissible.

The system shall support virtual server environments by default.

The system shall include, at no additional cost, one (1) year of Software Assurance.

2.16.6.2 Approved Products

The Critical Infrastructure Monitoring System shall be Liebert Nform® as manufactured by Emerson Network Power®, Liebert Corporation. No substitutions shall be accepted.

2.16.6.3 Scope of Work

Owner-Supplied Items

The owner shall furnish the following system components:

- Network (LAN) hardware and software required to provide an Ethernet backbone to be used for transport of IP data packets from network interface cards installed in all equipment to the Critical Infrastructure server and to the Liebert Nform workstations. These components may include hubs, routers, cabling, network operating systems, firewalls, IP addresses, virtual private network (VPN) and other components as required. The owner shall supply network drops for the Critical Infrastructure server, workstation clients and all network-interfaced equipment.
- Dedicated Critical Infrastructure server meeting the following minimum requirements:
 - Microsoft® Windows® 7, XP, 2003, Windows Vista® or Windows Server® 2008 operating system
 - Pentium™ 3.0GHz single processor or better (1.8GHz dual processor or better recommended)
 - 4 GB of RAM (memory) or better
 - 40 GB hard drive (SCSI recommended)
 - 10/100 BaseT network port or better
 - Monitor / keyboard and mouse port as required for setup
 - Standard USB ports
 - CD or DVD-ROM drive for software installation (CD/DVD-RW suggested for installation and backup)
 - Critical Infrastructure server may be Virtual Environment compatible
- Critical Infrastructure Workstation PCs meeting the following minimum requirements:
 - System should meet the minimum requirements for Microsoft Windows 7, XP, 2003, Vista or Server 2008 operating systems.
 - Microsoft Internet Explorer® v6.0 or higher
 - 1 GB RAM
 - Hard disk with 10GB free space

The owner shall supply the following to facilitate system implementation:

- IP addresses and subnet masks and other information as required to configure network devices
- A person as the nominated system owner for administrator purposes
- Secure location for hardware and server

Critical Infrastructure System Vendor Responsibilities

Provide hardware and software as listed.

- Critical Infrastructure software and licenses for server and workstation installations.
- Software Assurance for the first year at no additional cost.
- 7 x 24 system application and service support through a toll-free telephone number.
- Warranty (parts and labor) per the manufacturer's warranty statement.
- Vendor shall be ISO 9001 listed for design and manufacture of environmental control systems for Critical Monitoring and Control applications.

2.16.7 Liebert IntelliSlot® SiteLink-E® Card

The Liebert IntelliSlot SiteLink-E Card shall provide ground fault isolated connection to a Liebert SiteLink-E for monitoring and management. Liebert SiteLink-E supports Emerson interfaces as a BACnet router that provides the communication link between Liebert units and other protocols and modules. The Liebert SiteLink-E is designed to communicate with Liebert equipment—cooling units, UPS's and PDU's—and route the information over a BACnet, Modbus or LONWorks™ network to a Building Automation System (BAS) workstation. This shall be required for communication with Liebert SiteScan® Web 4.0 or newer.

2.16.8 Liebert Liqui-tect® 410 Point Leak Detection Sensor for Remote Mounting

A total of _____ (quantity) solid-state water sensor(s) with no moving parts and hermetically sealed to keep out dust and dirt shall be provided. The Liebert Liqui-tect 410 (LT410) shall provide a single-point detection of leaks. The point detection sensor shall have two gold-plated sensing probes to prevent corrosion resistance and to provide accurate readings. The LT410 shall constantly monitor points for leaks, internal faults and power failures and warn of any abnormal conditions. Mounting brackets shall allow for sensor height adjustment and leveling. The LT410 shall provide two independent outputs to signal both a local alarm panel and a remote building management system or external equipment. The LT410 shall be rated for 24VAC, 50/60Hz and 0.10 amp.

2.16.9 Liebert Liqui-tect 460 Zone Leak Detection Module with Cable Kit for Remote Mounting

A total of _____ (quantity) zone water sensor cables with no moving parts and hermetically sealed to keep out dust and dirt shall be provided. The Liebert Liqui-tect 460 (LT460) shall provide a zone detection of leaks. The LT460 shall constantly monitor points for leaks, internal faults and power failures and warn of any abnormal conditions. LED's shall provide status indication and also ensure the cable is properly installed and operational under raised floors. The LT460 shall provide two independent outputs provide a signal to a local alarm panel, Liebert environmental unit, remote building management system or external equipment.

Liebert Liqui-tect 460 Module

The LT460 shall consist of a metal enclosure with a hinged top door providing access to the internal circuit board for wiring termination and configuration of DIP switches. The LT460 shall monitor up to 100 feet (30m) of connected LT500Y leak detection cable. The LT460 shall be rated for 24VAC, 50/60Hz and 0.12A.

LT500Y Leak Detection Cable

The cable material and construction shall allow the cable to lie flat when used with hold-down clips. The LT500Y shall be plenum-rated and UL-listed for safe operation. Cables shall be available in lengths of 20, 25, 30, 35 and 45 feet (6, 7.6, 9, 10.6 and 13.7m).

2.17 Heat Rejection

2.17.1 Air-Cooled Microchannel Condenser

2.17.1.1 Standard Features

The condenser shall consist of microchannel condenser coil(s), propeller fan(s) direct-driven by individual fan motor(s), electrical controls, housing and mounting legs. The Liebert air-cooled condenser shall provide positive refrigerant head pressure control to the indoor cooling unit by adjusting heat rejection capacity. Microchannel coils shall provide superior heat transfer, reduce air-side pressure drop, increase energy efficiency and shall significantly reduce the system refrigerant volume required. EC fans and fan operating techniques shall provide reduced maximum sound levels. Various methods shall be available to match indoor unit type, maximum outdoor design ambient and maximum sound requirements.

2.17.1.2 Condenser Coil

2.17.1.2.1 Aluminum Microchannel Coil

Liebert microchannel coils shall be constructed of aluminum microchannel tubes, fins and manifolds. Tubes shall be flat and contain multiple, parallel flow microchannels and span between aluminum headers. Full-depth, louvered aluminum fins shall fill spaces between the tubes. Tubes, fins and aluminum headers shall be oven-brazed to form a complete refrigerant-to-air heat exchanger coil. Copper stub pipes shall be electric resistance welded to aluminum coils and joints protected with polyolefin to seal joints from corrosive environmental elements. Coil assemblies shall be factory leak-tested at a minimum of 300 psig (2068kPag). Hot gas and liquid lines shall be copper and shall be brazed using nitrogen gas flow to the stub pipes with spun-closed ends for customer piping connections. Complete coil/piping assembly shall be then filled and sealed with an inert gas holding charge for shipment.

2.17.1.2.2 Aluminum Microchannel Coil with E-Coat

Aluminum microchannel coil with E-coat shall provide a flexible epoxy coating to all coil surface areas without material bridging between fins. E-coat shall increase coil corrosion protection and shall reduce heat rejection capacity degradation to less than 10% after a severe 2000 hour 5% neutral salt spray test (ref. ASTM B117). The coating process shall ensure complete coil encapsulation, and the color shall be black.

2.17.1.3 Fan Motor/Blade Assembly

The fan motor/blade assembly shall have an external rotor motor, fan blades and fan/finger guard. Fan blades shall be constructed of cast aluminum or glass-reinforced polymeric material. Fan guards shall be heavy gauge, close-meshed steel wire, coated with a black, corrosion-resistant finish. Fan terminal blocks shall be located in an IP54 enclosure located on the top of the fan motor. Fan assemblies shall be factory-balanced, tested before shipment and mounted securely to the condenser structure.

2.17.1.3.1 EC Fan Motor

The EC fan motors shall be electronically commutated for variable speed operation and shall have ball bearings. The EC fans shall provide internal overload protection through built-in electronics. Each EC fan motor shall have a built-in controller and communication module, linked via RS-485 communication wire to each fan and the Premium Control Board, allowing each fan to receive and respond to precise fan speed inputs from the Premium Control Board

2.17.1.4 Electrical Controls

Electrical controls and service connection terminals shall be provided and factory-wired inside the attached control panel section. A locking disconnect switch shall be factory-mounted and wired to the electrical panel and controlled via an externally mounted locking and lockable door handle. Only high-voltage supply wiring and low-voltage indoor unit communication/interlock wiring shall be required at condenser installation.

2.17.1.4.1 Premium Control

The EC fan/Premium Control System shall include an electronic control board, EC fan motor(s) with internal overload protection, refrigerant and ambient temperature thermistors and refrigerant pressure transducers. The control board shall receive an indoor unit run signal via field-supplied low-voltage interlock wires to the compressor side switch via field-supplied CANbus communication wires from the indoor unit's Liebert iCOM® or via both. The control board shall use sensor and communication inputs to maintain refrigerant pressure by controlling each EC fan on the same refrigerant circuit to the same speed.

2.17.1.5 Cabinet

The condenser cabinet shall be constructed of bright aluminum sheet and divided into individual fan sections by full width baffles. Internal structural support members, including the coil support frame, shall be galvanized steel for strength and corrosion resistance. Panel doors shall be provided on two sides of each coil/fan section to permit coil cleaning. An electrical panel shall be contained inside a factory mounted, NEMA 3R weatherproof electrical enclosure.

2.17.1.6 Mounting Legs

2.17.1.6.1 Standard Aluminum Legs

Aluminum legs shall be provided to mount the unit for vertical air discharge with rigging holes for hoisting the unit into position. Standard height shall be 18in. (457mm).

2.17.1.6.2 Optional Galvanized Steel Legs with Bracing

Condensers shall be shipped with 36in. (914mm) mounting legs with stabilization bracing. Legs, bracing and hardware shall be galvanized steel.

2.17.1.6.2 Optional Galvanized Steel Legs with Bracing

Condensers shall be shipped with 48in. (1219mm) mounting legs with stabilization bracing. Legs, bracing and hardware shall be galvanized steel.

2.17.1.6.2 Optional Galvanized Steel Legs with Bracing

Condensers shall be shipped with 60in. (1524mm) mounting legs with stabilization bracing. Legs, bracing and hardware shall be galvanized steel.

2.17.1.7 Condenser Accessories

2.17.1.7.1 Liebert Lee-Temp™ Receiver Kit

Liebert Lee-Temp Receiver Kit shall contain an insulated, heated receiver tank with sight glasses, mounting plate, mounting hardware, pressure relief valve, rotalock valve for refrigerant charge isolation and piping assembly with head pressure operated 3-way valve and check valve. Components shall be field-assembled to the condenser. The three-way valve shall sense refrigerant head pressure and adjust the flooding charge in the condenser coil to adjust the condenser heat rejection capacity.

2.17.1.7.2 Fusible Plug Kit

A fusible plug kit shall be field-installed on the liquid line for compliance with building codes requiring refrigerant relief during high temperature and building fire conditions.

2.17.1.7.3 IBC/OSHPD Seismic Certification and IBC Wind/Snow Load Complaint

IBC/OSHPD Seismic Certification and IBC Wind/Snow Load Compliant condensers shall be provided with any applicable bracing and field installation instructions. Condensers shall bear a label certifying compliance with IBC/OSHPD requirements.

2.17.2 Drycooler

The Liebert drycooler is a low-profile, direct-drive propeller fan-type air-cooled fluid cooling unit. The drycooler shall be constructed with an aluminum cabinet and a copper-tube aluminum fin coil. All electrical connections and controls shall be enclosed in an integral, weatherproof section of the drycooler. The drycooler shall be designed for _____ °F (°C) ambient.

2.17.2.1 Fan Cycling Control

Two or more thermostats shall be employed on drycoolers with two or more fans to cycle fans or groups of fans in response to leaving fluid temperatures. The thermostat setpoints shall be listed on the factory-supplied schematic.

2.17.2.2 Pump Controls

Single Pump Option: Pump controls for a single glycol pump up to 7.5 hp shall be incorporated into the same integral electrical panel as the drycooler fan controls and may include fuses or circuit breakers as required for the pump motor. Pump voltage, phase and frequency shall be the same as the drycooler voltage, phase and frequency.

Dual Pump Option: Pump controls for a dual glycol pump system shall operate one pump as primary and the second pump shall operate as a standby pump. Pump controls shall be incorporated into the same integral electrical panel controlling drycooler fans. A field-supplied flow switch shall sense loss of flow and switch to the standby pump for continuous system operation. An internal switch shall allow manual selection of the primary (lead) pump.

2.17.2.3 Pump Package

2.17.2.3.1 Single Pump Package

This system shall be provided with a centrifugal pump mounted in a weatherproof and vented enclosure. The pump shall be rated for ____ GPM (____ l/m) at ____ ft. (____ kPa) of head and operate on ____ volt, 3-phase, ____ Hz.

2.18.2.3.1 Dual Pump Package

The dual pump package shall include pumps, enclosure and field-mounted flow switch. The standby pump shall automatically start up on failure of the lead pump by drycooler pump controls or by a separate factory-wired control box and shall include a lead/ lag switch for the pumps. Each pump shall be rated for _____ GPM (____ l/s) at ____ ft. (____ kPa) of head.

3.0 EXECUTION

3.1 Installation of Thermal Management Units

3.1.1 General

Install cooling units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated and maintain manufacturer's recommended clearances.

3.1.2 Electrical Wiring

Install and connect electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's electrical connection diagram submittal to electrical contractor.

3.1.3 Piping Connections

Install and connect devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.

3.1.4 Refrigerant Charging

Charge completed cooling system in accordance with manufacturer's refrigerant charging instructions.

3.2 Field Quality Control

Start up cooling units in accordance with manufacturer's startup instructions. Test controls and demonstrate compliance with requirements. These specifications describe requirements for a computer room environmental control system. The system shall be designed to maintain temperature and humidity conditions in the rooms containing electronic equipment.

The manufacturer shall design and furnish all equipment to be fully compatible with heat dissipation requirements.

3.2.1 Supply and Drain Water Piping

Connect water supply and drains to air conditioning unit. Provide pitch and trap as manufacturer's instructions and local codes require.

3.3 Seismic IBC/OSHPD

Install unit in accordance with manufacturer's installation instructions provided with seismic option. Firmly anchor maintaining manufacturer's recommended clearances. Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection and attachment to non-building structures must be outlined and approved by the Engineer of Record for the projection or building. Wiring and piping connections must permit movement in three dimensions and isolate the unit from field connections. Electrical conduit shall be flexible, having at least one bend between the rigid connection at the unit cabinet and the connection to rigid conduit or foundation. The piping flexible connection or loop must be suitable for the operation pressure and temperature of the system. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.

Install condenser in accordance with manufacturer's installation instructions provided with seismic option. Firmly anchor maintaining manufacturer's recommended clearances. Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection and attachment to non-building structures must be outlined and approved by the Engineer of Record for the projection or building. Wiring and piping connections must permit movement in three dimensions and isolate the unit from field connections. Electrical conduit shall be flexible, having at least one bend between the rigid connection at the unit cabinet and the connection to rigid conduit or foundation. The piping flexible connection or loop must be suitable for the operation pressure and temperature of the system. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.

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